

# Semiconductor Fundamentals Volume I 2nd Edition

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## FRANKLIN LIZETH

*Fundamentals of the Physics of Solids* Addison-Wesley Longman  
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.

**Advanced Semiconductor Fundamentals** Woodhead Publishing

Semiconductors are at the heart of modern living. Almost everything we do, be it work, travel, communication, or entertainment, all depend on some feature of semiconductor technology. Comprehensive Semiconductor Science and Technology, Six Volume Set captures the breadth of this important field, and presents it in a single source to the large audience who study, make, and exploit semiconductors. Previous attempts at this achievement have been abbreviated, and have omitted important topics. Written and Edited by a truly international team of experts, this work delivers an objective yet cohesive global review of the semiconductor world. The work is

divided into three sections. The first section is concerned with the fundamental physics of semiconductors, showing how the electronic features and the lattice dynamics change drastically when systems vary from bulk to a low-dimensional structure and further to a nanometer size. Throughout this section there is an emphasis on the full understanding of the underlying physics. The second section deals largely with the transformation of the conceptual framework of solid state physics into devices and systems which require the growth of extremely high purity, nearly defect-free bulk and epitaxial materials. The last section is devoted to exploitation of the knowledge described in the previous sections to highlight the spectrum of devices we see all around us. Provides a comprehensive global picture of the semiconductor world Each of the work's three sections presents a complete description of one aspect of the whole Written and Edited by a truly international team of experts

*Physics of Semiconductor Devices* Springer Science & Business Media

"This concise introduction to semiconductor fabrication technology covers everything professionals need to know, from crystal growth to integrated devices and circuits. Throughout, the authors address both theory and the practical aspects of each major fabrication step, including crystal growth, silicon oxidation, photolithography, etching, diffusion, ion implantation, and thin film deposition. The book integrates Computer Modeling & Simulation tools throughout. Process simulation is used as a tool for what-if analysis and discussion. Comprehensive coverage of process sequence helps readers connect individual steps into a cohesive whole."--

**Solutions Manual** Prentice Hall

Advanced Semiconductor Fundamentals, Second Edition, by Robert F. Pierret is an advanced level presentation of the

underlying functional formalism routinely used in describing the operational behavior of solid state devices. The second edition provides an update of the topic presentation, semiconductor parametric information, and relevant references throughout the volume. There is also a 50% increase in the end-of-chapter problems. Given the success of the first edition, the second edition retains the same overall material coverage and a pedagogical approach in introducing necessary concepts, models, and formalism.

**Fundamentals of Semiconductors** Springer Science & Business Media

A practical guide to semiconductor manufacturing from processcontrol to yield modeling and experimental design Fundamentals of Semiconductor Manufacturing and Process Controlcovers all issues involved in manufacturing microelectronic devicesand circuits, including fabrication sequences, process control,experimental design, process modeling, yield modeling, and CIM/CAMsystems. Readers are introduced to both the theory and practice ofall basic manufacturing concepts. Following an overview of manufacturing and technology, the textexplores process monitoring methods, including those that focus onproduct wafers and those that focus on the equipment used toproduce wafers. Next, the text sets forth some fundamentals ofstatistics and yield modeling, which set the foundation for adetailed discussion of how statistical process control is used toanalyze quality and improve yields. The discussion of statistical experimental design offers readers apowerful approach for systematically varying controllable processconditions and determining their impact on output parameters thatmeasure quality. The authors introduce process modeling concepts,including several advanced process control topics such asrun-by-run, supervisory control, and process and

equipment diagnosis. Critical coverage includes the following: \* Combines process control and semiconductor manufacturing \* Unique treatment of system and software technology and management of overall manufacturing systems \* Chapters include case studies, sample problems, and suggested exercises \* Instructor support includes electronic copies of the figures and an instructor's manual Graduate-level students and industrial practitioners will benefit from the detailed examination of how electronic materials and supplies are converted into finished integrated circuits and electronic products in a high-volume manufacturing environment. An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department. An Instructor Support FTP site is also available.

Fundamentals of Semiconductor Manufacturing and Process Control Academic Press

This Third Edition updates a landmark text with the latest findings. The Third Edition of the internationally lauded *Semiconductor Material and Device Characterization* brings the text fully up-to-date with the latest developments in the field and includes new pedagogical tools to assist readers. Not only does the Third Edition set forth all the latest measurement techniques, but it also examines new interpretations and new applications of existing techniques. *Semiconductor Material and Device Characterization* remains the sole text dedicated to characterization techniques for measuring semiconductor materials and devices. Coverage includes the full range of electrical and optical characterization methods, including the more specialized chemical and physical techniques. Readers familiar with the previous two editions will discover a thoroughly revised and updated Third Edition, including: Updated and revised figures and examples reflecting the most current data and information 260 new references offering access to the latest research and discussions in specialized topics New problems and review questions at the end of each chapter to test readers' understanding of the material In addition, readers will find fully updated and revised sections in each chapter. Plus, two new chapters have been added: Charge-Based and Probe Characterization introduces charge-based measurement and Kelvin probes. This chapter also examines probe-based measurements, including scanning capacitance, scanning Kelvin force, scanning spreading resistance, and ballistic

electron emission microscopy. Reliability and Failure Analysis examines failure times and distribution functions, and discusses electromigration, hot carriers, gate oxide integrity, negative bias temperature instability, stress-induced leakage current, and electrostatic discharge. Written by an internationally recognized authority in the field, *Semiconductor Material and Device Characterization* remains essential reading for graduate students as well as for professionals working in the field of semiconductor devices and materials. An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department.

**Contacts to Semiconductors** Springer

WORLD-CLASS SEMICONDUCTOR MANUFACTURING EXPERTISE AT YOUR FINGERTIPS This is a comprehensive reference to the semiconductor manufacturing process and ancillary facilities -- from raw material preparation to packaging and testing, applying basics to emerging technologies. Readers charged with optimizing the design and performance of manufacturing processes will find all the information necessary to produce the highest quality chips at the lowest price in the shortest time possible. The *Semiconductor Manufacturing Handbook* provides leading-edge information on semiconductor wafer processes, MEMS, nanotechnology, and FPD, plus the latest manufacturing and automation technologies, including: Yield Management Automated Material Handling System Fab and Cleanroom Design and Operation Gas Abatement and Waste Treatment Management And much more Written by 60 international experts, and peer reviewed by a seasoned advisory board, this handbook covers the fundamentals of relevant technology and its real-life application and operational considerations for planning, implementing, and controlling manufacturing processes. It includes hundreds of detailed illustrations and a list of relevant books, technical papers, and websites for further research. This inclusive, wide-ranging coverage makes the *Semiconductor Manufacturing Handbook* the most comprehensive single-volume reference ever published in the field. STATE-OF-THE-ART SEMICONDUCTOR TECHNOLOGIES AND MANUFACTURING PROCESSES: SEMICONDUCTOR FUNDAMENTALS How Chips Are Designed and Made \* Substrates \* Copper and Low-k Dielectrics \* Silicide Formation \* Plasma \* Vacuum \* Photomask WAFER PROCESSING TECHNOLOGIES Microlithography \* Ion Implantation \* Etch \* PVD/ALD \* CVD \* ECD

\* Epitaxy \* CMP \* Wet Cleaning FINAL MANUFACTURING Packaging \* Grinding, Stress Relief, Dicing \* Inspection, Measurement, and Testing NANOTECHNOLOGY, MEMS, AND FPD GAS AND CHEMICALS Specialty Gas System and DCA \* Gas Abatement Systems \* Chemical and Slurries Delivery System \* Ultra Pure Water FAB YIELD, OPERATIONS, AND FACILITIES Yield Management \* Automated Materials Handling System \* Metrology \* Six Sigma \* Advanced Process Control \* EHS \* Fab Design and Construction \* Cleanroom \* Vibration and Acoustic Control \* ESD \* Airborne Molecular Control \* Particle Monitoring \* Wastewater Neutralization Systems

Semiconductor Device Fundamentals William Andrew

This book presents the underlying functional formalism routinely used in describing the operational behavior of solid state devices.

**Semiconductor Lasers I** Pearson

This textbook gives a complete and fundamental introduction to the properties of III-V compound semiconductor devices, highlighting the theoretical and practical aspects of their device physics. Beginning with an introduction to the basics of semiconductor physics, it presents an overview of the physics and preparation of compound semiconductor materials, as well as a detailed look at the electrical and optical properties of compound semiconductor heterostructures. The book concludes with chapters dedicated to a number of heterostructure electronic and photonic devices, including the high-electron-mobility transistor, the heterojunction bipolar transistor, lasers, unipolar photonic devices, and integrated optoelectronic devices. Featuring chapter-end problems, suggested references for further reading, as well as clear, didactic schematics accompanied by six information-rich appendices, this textbook is ideal for graduate students in the areas of semiconductor physics or electrical engineering. In addition, up-to-date results from published research make this textbook especially well-suited as a self-study and reference guide for engineers and researchers in related industries.

Semiconductor Material and Device Characterization Cambridge University Press

The purpose of this book is to provide the reader with a self-contained treatment of fundamental solid state and semiconductor device physics. The material presented in the text is based upon the lecture notes of a one-year graduate course

sequence taught by this author for many years in the Department of Electrical Engineering of the University of Florida. It is intended as an introductory textbook for graduate students in electrical engineering. However, many students from other disciplines and backgrounds such as chemical engineering, materials science, and physics have also taken this course sequence, and will be interested in the material presented herein. This book may also serve as a general reference for device engineers in the semiconductor industry. The present volume covers a wide variety of topics on basic solid state physics and physical principles of various semiconductor devices. The main subjects covered include crystal structures, lattice dynamics, semiconductor statistics, energy band theory, excess carrier phenomena and recombination mechanisms, carrier transport and scattering mechanisms, optical properties, photoelectric effects, metal-semiconductor devices, the p-n junction diode, bipolar junction transistor, MOS devices, photonic devices, quantum effect devices, and high speed III-V semiconductor devices. The text presents a unified and balanced treatment of the physics of semiconductor materials and devices. It is intended to provide physicists and materials scientists with more device backgrounds, and device engineers with a broader knowledge of fundamental solid state physics.

**Semiconductor Manufacturing Handbook** Springer Science & Business Media

The second edition examines in detail three of the most basic members of the field device family to introduce the reader to relevant terms, concepts, models, and analytical procedures.

**The PN Junction Diode** Springer Science & Business Media  
Fundamentals of Semiconductor Devices provides a realistic and practical treatment of modern semiconductor devices. A solid understanding of the physical processes responsible for the electronic properties of semiconductor materials and devices is emphasized. With this emphasis, the reader will appreciate the underlying physics behind the equations derived and their range of applicability. The author's clear writing style, comprehensive coverage of the core material, and attention to current topics are key strengths of this book.

**Field Effect Devices** Springer Nature

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.

**Semiconductor Device Fundamentals** Springer Science & Business Media

This book presents those terms, concepts, equations, and models that are routinely used in describing the operational behavior of solid state devices. The second edition provides many new problems and illustrative examples.

**III-V Compound Semiconductors and Devices** Prentice Hall

The reader is holding the second volume of a three-volume textbook on solid state physics. This book is the outgrowth of the courses I have taught for many years at Eötvös University, Budapest, for undergraduate and graduate students under the titles Solid-State Physics and Modern Solid-State Physics. The main motivation for the publication of my lecture notes as a book was that none of the truly numerous textbooks covered all those areas that I felt should be included in a multi-semester course. Especially, if the course strives to present solid-state physics in a unified structure, and aims at discussing not only classic chapters of the subject matter but also (in more or less detail) problems that are of great interest for today's researcher as well. Besides, the book presents a much larger material than what can be covered in a two- or three-semester course. In the first part of the first volume the analysis of crystal symmetries and structure goes into details that certainly cannot be included in a usual course on solid-state physics. The same applies, among others, to the discussion of the methods used in the determination of band structure, the properties of Fermi liquids and non-Fermi liquids, and the theory of unconventional superconductors in the present and third volumes. These parts can be assigned as supplementary reading for interested students, or can be discussed in advanced courses.

**Semiconductor Device Fundamentals** Prentice Hall

Excellent bridge between general solid-state physics textbook and research articles packed with providing detailed explanations of the electronic, vibrational, transport, and optical properties of

semiconductors "The most striking feature of the book is its modern outlook ... provides a wonderful foundation. The most wonderful feature is its efficient style of exposition ... an excellent book." Physics Today "Presents the theoretical derivations carefully and in detail and gives thorough discussions of the experimental results it presents. This makes it an excellent textbook both for learners and for more experienced researchers wishing to check facts. I have enjoyed reading it and strongly recommend it as a text for anyone working with semiconductors ... I know of no better text ... I am sure most semiconductor physicists will find this book useful and I recommend it to them." Contemporary Physics Offers much new material: an extensive appendix about the important and by now well-established, deep center known as the DX center, additional problems and the solutions to over fifty of the problems at the end of the various chapters.

**Fundamentals of Modern VLSI Devices** McGraw-Hill Science, Engineering & Mathematics

"An Introduction to Semiconductor Devices by Donald Neamen is designed to provide a fundamental understanding of the characteristics, operations, and limitations of semiconductor devices. In order to meet this goal, the book brings together explanations of fundamental physics of semiconductor materials and semiconductor device physics." "This new text provides an accessible and modern approach to the material. Aimed at the undergraduate, Neamen keeps coverage of quantum mechanics to a minimum and labels the most advanced material as optional. MOS transistors are covered before bipolar transistors to reflect the dominance of MOS coverage in today's world."--BOOK JACKET.

**Comprehensive Semiconductor Science and Technology** John Wiley & Sons

The detailed and comprehensive presentation is unique in that it encourages the reader to consider different semiconductor lasers from different angles. Emphasis is placed on recognizing common concepts such as operating principles and structure, and solving problems based on individual situations. The treatment is enhanced by an historical account of advances in semiconductor lasers over the years, discussing both those ideas that have persisted over the years and those that have faded out.

**Handbook of Semiconductor Technology, Volume 2** World Scientific

"Fundamentals of Solid State Engineering, 2nd Edition, provides a multi-disciplinary introduction to solid state engineering, combining concepts from physics, chemistry, electrical engineering, materials science and mechanical engineering. Revised throughout, this third edition includes new topics such as electron-electron and electron-phonon interactions, in addition to the Kane effective mass method. A chapter devoted to quantum mechanics has been expanded to cover topics such as the harmonic oscillator, the hydrogen atom, the quantum mechanical description of angular momentum and the origin of spin. This textbook also features an improved transport theory description, which now goes beyond Drude theory, discussing the Boltzmann approach. Introducing students to the rigorous quantum mechanical way of thinking about and formulating transport processes, this textbook presents the basic physics concepts and thorough treatment of semiconductor characterization technology, designed for solid state engineers."--Publisher's

website.

Fundamentals of Semiconductor Physics and Devices John Wiley & Sons

This book covers the device physics of semiconductor lasers in five chapters written by recognized experts in this field. The volume begins by introducing the basic mechanisms of optical gain in semiconductors and the role of quantum confinement in modern quantum well diode lasers. Subsequent chapters treat the effects of built-in strain, one of the important recent advances in the technology of these lasers, and the physical mechanisms underlying the dynamics and high speed modulation of these devices. The book concludes with chapters addressing the control of photon states in squeezed-light and microcavity structures, and electron states in low dimensional quantum wire and quantum dot lasers. The book offers useful information for both readers unfamiliar with semiconductor lasers, through the introductory parts of each chapter, as well as a state-of-the-art discussion of

some of the most advanced semiconductor laser structures, intended for readers engaged in research in this field. This book may also serve as an introduction for the companion volume, Semiconductor Lasers II: Materials and Structures, which presents further details on the different material systems and laser structures used for achieving specific diode laser performance features. Introduces the reader to the basics of semiconductor lasers Covers the fundamentals of lasing in semiconductors, including quantum confined and microcavity structures Beneficial to readers interested in the more general aspects of semiconductor physics and optoelectronic devices, such as quantum confined heterostructures and integrated optics Each chapter contains a thorough introduction to the topic geared toward the non-expert, followed by an in-depth discussion of current technology and future trends Useful for professionals engaged in research and development Contains numerous schematic and data-containing illustrations