

Semiconductor Device Fundamentals Pierret Solutions

The Science and Engineering of Microelectronic Fabrication provides a thorough introduction to the field of microelectronic processing. Geared toward a wide audience, it may be used for upper-level undergraduate or first year graduate courses and as a handy reference for professionals. The text covers all the basic unit processes used to fabricate integrated circuits, including photolithography, plasma and reactive ion etching, ion implantation, diffusion, oxidation, evaporation, vapor phase epitaxial growth, sputtering, and chemical vapor deposition. Advanced processing topics such as rapid thermal processing, non-optical lithography, molecular beam epitaxy, and metal organic chemical vapor deposition are also presented. The physics and chemistry of each process is introduced along with descriptions of the equipment used for the manufacturing of integrated circuits. The text also discusses the integration of these processes into common technologies such as CMOS, double poly bipolar, and GaAs MESFETs. Complexity/performance tradeoffs are evaluated along with a description of the current state-of-the-art devices. Each chapter includes sample problems with solutions. The text makes use of the process simulation package SUPREM to demonstrate impurity profiles of practical interest. The new edition includes complete chapter coverage of MEMS including: Fundamentals of Mechanics, Stress in Thin Films, Mechanical to Electrical Transduction, Mechanics of Common MEMS Devices, Bulk Micromachining Etching Techniques, Bulk Micromachining Process Flow, Surface Micromachining Basics, Surface

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Micromachining Process Flow, MEMS Actuators, High Aspect Ratio Microsystems Technology (HARMST).

Semiconductor Device Physics and Design teaches readers how to approach device design from the point of view of someone who wants to improve devices and can see the opportunity and challenges. It begins with coverage of basic physics concepts, including the physics behind polar heterostructures and strained heterostructures. The book then details the important devices ranging from p-n diodes to bipolar and field effect devices. By relating device design to device performance and then relating device needs to system use the student can see how device design works in the real world.

Market_Desc: · Electrical Engineers Special Features: · Over 150 solved examples that clarify concepts are integrated throughout the text. · End-of-chapter summary tables and hundreds of figures are included to reinforce the intricacies of modern semiconductor devices· Coverage of device optimization issues shows the reader how in each device one has to trade one performance against another About The Book: This introductory text 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 are based. Next, the author focuses on the operation of the important semiconductor devices along with issues relating to the optimization of device performance.

The purpose of this book is to illustrate the magnificence of the fabless semiconductor ecosystem, and to give credit where credit is due. We trace the history of the semiconductor industry from both a technical and business perspective. We argue that the development of the

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fabless business model was a key enabler of the growth in semiconductors since the mid-1980s. Because business models, as much as the technology, are what keep us thrilled with new gadgets year after year, we focus on the evolution of the electronics business. We also invited key players in the industry to contribute chapters. These “In Their Own Words” chapters allow the heavyweights of the industry to tell their corporate history for themselves, focusing on the industry developments (both in technology and business models) that made them successful, and how they in turn drive the further evolution of the semiconductor industry. Although roughly a half-century old, the field of study associated with semiconductor devices continues to be dynamic and exciting. New and improved devices are being developed at an almost frantic pace. While the number of devices in complex integrated circuits increases and the size of chips decreases, semiconductor properties are now being engineered to fit design specifications. Semiconductor Device Fundamentals serves as an excellent introduction to this fascinating field. Based in part on the Modular Series on Solid State Devices, this textbook explains the basic terminology, models, properties, and concepts associated with semiconductors and semiconductor devices. The book provides detailed insight into the internal workings of building block device structures and systematically develops the analytical tools needed to solve practical device problems.

Semiconductor Device Fundamentals Pearson Education India
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Modern Semiconductor Devices for Integrated Circuits, First Edition introduces readers to the world of modern semiconductor devices with an emphasis on integrated circuit applications.

KEY TOPICS: Electrons and Holes in Semiconductors; Motion and Recombination of Electrons

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and Holes; Device Fabrication Technology; PN and Metal–Semiconductor Junctions; MOS Capacitor; MOS Transistor; MOSFETs in ICs—Scaling, Leakage, and Other Topics; Bipolar Transistor. MARKET: Written by an experienced teacher, researcher, and expert in industry practices, this succinct and forward-looking text is appropriate for anyone interested in semiconductor devices for integrated circuits, and serves as a suitable reference text for practicing engineers.

Electrical Engineering Advanced Theory of Semiconductor Devices

Semiconductor devices are ubiquitous in today's world and are found increasingly in cars, kitchens and electronic door locks, attesting to their presence in our daily lives. This comprehensive book provides the fundamentals of semiconductor device theory from basic quantum physics to computer-aided design. Advanced Theory of Semiconductor Devices will improve your understanding of computer simulation of devices through a thorough discussion of basic equations, their validity, and numerical solutions as they are contained in current simulation tools. You will gain state-of-the-art knowledge of devices used in both III–V compounds and silicon technology. Specially featured are novel approaches and explanations of electronic transport, particularly in p–n junction diodes. Close attention is also given to innovative treatments of quantum-well laser diodes and hot electron effects in silicon technology. This in-depth book is

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written for engineers, graduate students, and research scientists in solid-state electronics who want to gain a better understanding of the principles underlying semiconductor devices.

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.

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.

The awaited revision of *Semiconductor Devices: Physics and Technology* offers more than 50% new or revised material that reflects a multitude of important discoveries and advances in device physics and integrated circuit processing. Offering a basic introduction to physical principles of modern semiconductor devices and their advanced fabrication technology, the third edition presents students with theoretical and practical aspects of every step in device characterizations and fabrication, with an emphasis on integrated circuits. Divided into three parts, this text covers the basic properties of semiconductor materials, emphasizing silicon and gallium arsenide; the physics and characteristics of semiconductor devices bipolar, unipolar special microwave and photonic devices; and the latest processing technologies, from crystal growth to

lithographic pattern transfer.

From theory and fundamentals to the latest advances in computational and experimental modal analysis, this is the definitive, updated reference on structural dynamics. This edition updates Professor Craig's classic introduction to structural dynamics, which has been an invaluable resource for practicing engineers and a textbook for undergraduate and graduate courses in vibrations and/or structural dynamics. Along with comprehensive coverage of structural dynamics fundamentals, finite-element-based computational methods, and dynamic testing methods, this Second Edition includes new and expanded coverage of computational methods, as well as introductions to more advanced topics, including experimental modal analysis and "active structures." With a systematic approach, it presents solution techniques that apply to various engineering disciplines. It discusses single degree-of-freedom (SDOF) systems, multiple degrees-of-freedom (MDOF) systems, and continuous systems in depth; and includes numeric evaluation of modes and frequency of MDOF systems; direct integration methods for dynamic response of SDOF systems and MDOF systems; and component mode synthesis. Numerous illustrative examples help engineers apply the techniques and methods to challenges they face in the real world. MATLAB(r) is extensively used throughout the book, and many of the .m-

files are made available on the book's Web site. Fundamentals of Structural Dynamics, Second Edition is an indispensable reference and "refresher course" for engineering professionals; and a textbook for seniors or graduate students in mechanical engineering, civil engineering, engineering mechanics, or aerospace engineering.

MEMS technology and applications have grown at a tremendous pace, while structural dimensions have grown smaller and smaller, reaching down even to the molecular level. With this movement have come new types of applications and rapid advances in the technologies and techniques needed to fabricate the increasingly miniature devices that are literally changing our world. A bestseller in its first edition, Fundamentals of Microfabrication, Second Edition reflects the many developments in methods, materials, and applications that have emerged recently. Renowned author Marc Madou has added exercise sets to each chapter, thus answering the need for a textbook in this field. Fundamentals of Microfabrication, Second Edition offers unique, in-depth coverage of the science of miniaturization, its methods, and materials. From the fundamentals of lithography through bonding and packaging to quantum structures and molecular engineering, it provides the background, tools, and directions you need to confidently choose fabrication methods and materials for a particular

miniaturization problem. New in the Second Edition Revised chapters that reflect the many recent advances in the field Updated and enhanced discussions of topics including DNA arrays, microfluidics, micromolding techniques, and nanotechnology In-depth coverage of bio-MEMs, RF-MEMs, high-temperature, and optical MEMs. Many more links to the Web Problem sets in each chapter A graduate textbook presenting the underlying physics behind devices that drive today's technologies. The book covers important details of structural properties, bandstructure, transport, optical and magnetic properties of semiconductor structures. Effects of low-dimensional physics and strain - two important driving forces in modern device technology - are also discussed. In addition to conventional semiconductor physics the book discusses self-assembled structures, mesoscopic structures and the developing field of spintronics. The book utilizes carefully chosen solved examples to convey important concepts and has over 250 figures and 200 homework exercises. Real-world applications are highlighted throughout the book, stressing the links between physical principles and actual devices. Electronic and Optoelectronic Properties of Semiconductor Structures provides engineering and physics students and practitioners with complete and coherent coverage of key modern semiconductor concepts. A solutions manual and set of viewgraphs for use in lectures are available for

instructors, from solutions@cambridge.org.

This Solution Manual, a companion volume of the book, *Fundamentals of Solid-State Electronics*, provides the solutions to selected problems listed in the book. Most of the solutions are for the selected problems that had been assigned to the engineering undergraduate students who were taking an introductory device core course using this book. This Solution Manual also contains an extensive appendix which illustrates the application of the fundamentals to solutions of state-of-the-art transistor reliability problems which have been taught to advanced undergraduate and graduate students. This book is also available as a set with *Fundamentals of Solid-State Electronics* and *Fundamentals of Solid-State Electronics — Study Guide*.

A practical guide to semiconductor manufacturing from process control to yield modeling and experimental design *Fundamentals of Semiconductor Manufacturing and Process Control* covers all issues involved in manufacturing microelectronic devices and circuits, including fabrication sequences, process control, experimental design, process modeling, yield modeling, and CIM/CAM systems. Readers are introduced to both the theory and practice of all basic manufacturing concepts. Following an overview of manufacturing and technology, the text explores process monitoring methods, including those that focus on product wafers and those that focus on the equipment used to produce wafers. Next, the text sets forth some fundamentals of statistics and yield modeling, which set the foundation for a detailed discussion of how statistical process

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control is used to analyze quality and improve yields. The discussion of statistical experimental design offers readers a powerful approach for systematically varying controllable process conditions and determining their impact on output parameters that measure quality. The authors introduce process modeling concepts, including several advanced process control topics such as run-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.

Richard Jaeger and Travis Blalock present a balanced coverage of analog and digital circuits; students will develop a comprehensive understanding of the basic techniques of modern electronic circuit design, analog and digital, discrete and integrated. A broad spectrum of topics are included in *Microelectronic Circuit Design* which gives the professor the option to easily select and customize the material to satisfy a two-

semester or three-quarter sequence in electronics. Jaeger/Blalock emphasizes design through the use of design examples and design notes. Excellent pedagogical elements include chapter opening vignettes, chapter objectives, “Electronics in Action” boxes, a problem-solving methodology, and “Design Note” boxes. The use of the well-defined problem-solving methodology presented in this text can significantly enhance an engineer’s ability to understand the issues related to design. The design examples assist in building and understanding the design process.

The new edition of the most detailed and comprehensive single-volume reference on major semiconductor devices The Fourth Edition of *Physics of Semiconductor Devices* remains the standard reference work on the fundamental physics and operational characteristics of all major bipolar, unipolar, special microwave, and optoelectronic devices. This fully updated and expanded edition includes approximately 1,000 references to original research papers and review articles, more than 650 high-quality technical illustrations, and over two dozen tables of material parameters. Divided into five parts, the text first provides a summary of semiconductor properties, covering energy band, carrier concentration, and transport properties. The second part surveys the basic building blocks of semiconductor devices, including p-n junctions, metal-semiconductor contacts, and metal-insulator-semiconductor (MIS) capacitors. Part III examines bipolar transistors, MOSFETs (MOS field-effect transistors), and other field-effect transistors such as JFETs (junction field-effect-transistors) and MESFETs (metal-

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semiconductor field-effect transistors). Part IV focuses on negative-resistance and power devices. The book concludes with coverage of photonic devices and sensors, including light-emitting diodes (LEDs), solar cells, and various photodetectors and semiconductor sensors. This classic volume, the standard textbook and reference in the field of semiconductor devices: Provides the practical foundation necessary for understanding the devices currently in use and evaluating the performance and limitations of future devices Offers completely updated and revised information that reflects advances in device concepts, performance, and application Features discussions of topics of contemporary interest, such as applications of photonic devices that convert optical energy to electric energy Includes numerous problem sets, real-world examples, tables, figures, and illustrations; several useful appendices; and a detailed solutions manual Explores new work on leading-edge technologies such as MODFETs, resonant-tunneling diodes, quantum-cascade lasers, single-electron transistors, real-space-transfer devices, and MOS-controlled thyristors Physics of Semiconductor Devices, Fourth Edition is an indispensable resource for design engineers, research scientists, industrial and electronics engineering managers, and graduate students in the field.

Resistivity -- Carrier and doping density -- Contact resistance and Schottky barriers -- Series resistance, channel length and width, and threshold voltage -- Defects -- Oxide and interface trapped charges, oxide thickness -- Carrier lifetimes -- Mobility -- Charge-

based and probe characterization -- Optical characterization -- Chemical and physical characterization -- Reliability and failure analysis.

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.

The transistor is the key enabler of modern electronics. Progress in transistor scaling has pushed channel lengths to the nanometer regime where traditional approaches to device physics are less and less suitable. These lectures describe a way of understanding MOSFETs and other transistors that is much more suitable than traditional approaches when the critical dimensions are measured in nanometers. It uses a novel, "bottom-up approach" that agrees with traditional methods when devices are large, but that also works for nano-devices. Surprisingly, the final result looks much like the traditional, textbook, transistor models, but the parameters in the equations have simple, clear interpretations at the nanoscale. The objective is to provide readers with an understanding of the essential physics of nanoscale transistors as well as some of the practical technological considerations and fundamental limits. This book is written

in a way that is broadly accessible to students with only a very basic knowledge of semiconductor physics and electronic circuits. Complemented with online lecture by Prof Lundstrom: nanoHUB-U Nanoscale Transistor Contents: MOSFET Fundamentals: Overview The Transistor as a Black Box The MOSFET: A Barrier-Controlled Device MOSFET IV: Traditional Approach MOSFET IV: The Virtual Source Model MOS Electrostatics: Poisson Equation and the Depletion Approximation Gate Voltage and Surface Potential Mobile Charge: Bulk MOS Mobile Charge: Extremely Thin SOI 2D MOS Electrostatics The VS Model Revisited The Ballistic MOSFET: The Landauer Approach to Transport The Ballistic MOSFET The Ballistic Injection Velocity Connecting the Ballistic and VS Models Transmission Theory of the MOSFET: Carrier Scattering and Transmission Transmission Theory of the MOSFET Connecting the Transmission and VS Models VS Characterization of Transport in Nanotransistors Limits and Limitations Readership: Any student and professional with an undergraduate degree in the physical sciences or engineering.

This book integrates materials science with other engineering subjects such as physics, chemistry and electrical engineering. The authors discuss devices and technologies used by the electronics, magnetics and photonics industries and offer a perspective on the manufacturing technologies used in device fabrication. The new addition includes chapters on optical properties and devices and addresses nanoscale phenomena and nanoscience, a subject that has made

significant progress in the past decade regarding the fabrication of various materials and devices with nanometer-scale features.

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.

This book is designed to help readers gain a basic understanding of semiconductor devices and the physical operating principles behind them. This two-fold approach 1) provides the user with a sound understanding of existing devices, and 2) helps them develop the basic tools with which they can later learn about applications and the latest devices. The piece provides one of the most comprehensive treatments of all the important semiconductor devices, and reflects the most current trends in the technology and theoretical understanding of the devices. FEATURES/BENEFITS *NEW--Thoroughly updated to reflect the most current trends in the technology and theoretical understanding of devices. *NEW--Expanded description of silicon Czochralski growth, wafer production, and vapor phase epitaxy (Ch. 1). *NEW--Clearer discussion of chemical bonding, energy band formation and hole transport (Chs. 2, 3 and 4). *NEW--Consolidated coverage of p-n junction diodes and its applications (Ch. 5). *NEW--Greatly expanded/updated discussion of device fabrication processes (Ch. 5 and

appendices). *NEW--Earlier discussion of MOS devices (Ch. complementary MOS field effect transistors (MOSFETs) in integrated circuits today. *NEW--Major revision of chapter on Field Effect Transistors (Ch. 6)--Both in the underlying theory as well as discussion of a variety of short channel, high field and hot carrier effects in scaled, ultra-small MOSFETs. Includes extensive discussions of the current-voltage and capacitance-voltage characteristics of these devices--and the information that can be gleaned from such measurements. *NEW--Updated chapter on Bipolar Junction Transistors (BJTs) (Ch. 7)--To reflect current technology. Describes higher-order effects (including the Kirk effect and Webster effect); discusses the Gummel-Poon model (which is more elaborate and physically more accurate than the Ebers-Moll model); and updates the fabrication aspects of BJTs. *NEW--Consolidated coverage of optoelectronic devices in a single chapter (Ch. 8)--Brings the discussion of semiconductor lasers into the same chapter as LEDs and detectors *Reflects the growing importance of optoelectronics. *NEW--Updated coverage of integrated circuits (Ch. concerted shift to CMOS applications, such as logic and memory integrated circuits. *NEW--A section on the insulated gate bipolar transistor (Ch. 11)--A device that is gradually supplanting the semiconductor-controlled rectifier. *NEW--Real data--Wherever feasible, replaces idealized current-voltage and capacitance-

voltage plots with real data.

Offers a basic, up-to-date introduction to semiconductor fabrication technology, including both the theoretical and practical aspects of all major steps in the fabrication sequence Presents comprehensive coverage of process sequences Introduces readers to modern simulation tools Addresses the practical aspects of integrated circuit fabrication Clearly explains basic processing theory Suitable for undergraduates, postgraduates and professionals, this is a comprehensive text on physical and chemical equilibrium. De Nevers is also the author of Fluid Mechanics for Chemical Engineers.

Aimed primarily at the undergraduate students pursuing courses in semiconductor physics and semiconductor devices, this text emphasizes the physical understanding of the underlying principles of the subject. Since engineers use semiconductor devices as circuit elements, device models commonly used in the circuit simulators, e.g. SPICE, have been discussed in detail. Advanced topics such as lasers, heterojunction bipolar transistors, second order effects in BJTs, and MOSFETs are also covered. With such in-depth coverage and a practical approach, practising engineers and PG students can also use this book as a ready reference.

The second, updated edition of this essential reference book provides a wealth of

detail on a wide range of electronic and photonic materials, starting from fundamentals and building up to advanced topics and applications. Its extensive coverage, with clear illustrations and applications, carefully selected chapter sequencing and logical flow, makes it very different from other electronic materials handbooks. It has been written by professionals in the field and instructors who teach the subject at a university or in corporate laboratories. The Springer Handbook of Electronic and Photonic Materials, second edition, includes practical applications used as examples, details of experimental techniques, useful tables that summarize equations, and, most importantly, properties of various materials, as well as an extensive glossary. Along with significant updates to the content and the references, the second edition includes a number of new chapters such as those covering novel materials and selected applications. This handbook is a valuable resource for graduate students, researchers and practicing professionals working in the area of electronic, optoelectronic and photonic materials.

This modern, pedagogic textbook from leading author Behzad Razavi provides a comprehensive and rigorous introduction to CMOS PLL design, featuring intuitive presentation of theoretical concepts, extensive circuit simulations, over 200 worked examples, and 250 end-of-chapter problems. The perfect text for senior undergraduate and graduate students.

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This text builds a firm foundation in PN junction theory from a conceptual and mathematical viewpoint. The second edition adds a large number of end-of-chapter problems, solved exercises, and a new chapter on metal-semiconductor contacts.

This is the only comprehensive book in the market for engineers that covers the design of CMOS and bipolar analog integrated circuits. The fifth edition retains its completeness and updates the coverage of bipolar and CMOS circuits. A thorough analysis of a new low-voltage bipolar operational amplifier has been added to Chapters 6, 7, 9, and 11. Chapter 12 has been updated to include a fully differential folded cascode operational amplifier example. With its streamlined and up-to-date coverage, more engineers will turn to this resource to explore key concepts in the field.

Special Features *Computer-based exercises and homework problems -- unique to this text and comprising 25% of the total number of problems -- encourage students to address realistic and challenging problems, experiment with what if scenarios, and easily obtain graphical outputs. Problems are designed to progressively enhance MATLAB-use proficiency, so students need not be familiar with MATLAB at the start of your course. Program scripts that are answers to exercises in the text are available at no charge in electronic form (see Teaching Resources below). *Supplement and Review Mini-Chapters after each of the text's three parts contain an extensive review list of terms, test-like problem sets with answers, and detailed suggestions on supplemental reading to reinforce students' learning and help them prepare for exams. *Read-Only Chapters, strategically placed to provide a change of pace during the course, provide informative, yet enjoyable reading for students. *Measurement Details and Results samples offer students a realistic perspective on the seldom-perfect nature of device

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characteristics, contrary to the way they are often represented in introductory texts. Content
Highlig

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.

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

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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.

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