



Bipolar Semiconductor Devices

Steven T. Ruggiero



Bipolar Semiconductor Devices:

Bipolar Semiconductor Devices David J. Roulston, 1990 **Bipolar transistor and MOSFET device models** Kunihiro Suzuki, 2016-03-02 Continuous efforts to develop new semiconductor devices enable device manufacturers to make significant improvements in the information technology sector Bipolar transistors and MOSFETS are two special electronic device components that are used to construct very large scale integrated VLSI circuits allowing engineers to create powerful machines that are power efficient VLSI device characterization depends largely on semiconductor device modeling which is based on physical and electronic principles Bipolar transistor and MOSFET device models is a textbook that describes basic functions and characterization models of these two types of transistors Readers will learn about the processes employed to derive these models which will help them understand the modeling process Chapters in this text cover the fundamentals of semiconductor devices the pn junction high and low injection region models for bipolar transistors and different MOSFET models such as channel doping models and gated SOI models Key features of this book include step by step easy to understand presentation of model information on innovative semiconductor devices an overview of model derivation assumptions approximations and limitations novel experimental information on semiconductor parameters such as gate fringe capacitance silicided source drain resistance and threshold voltage shift Bipolar transistor and MOSFET device models is an essential learning resource for advanced students and professional engineers involved in semiconductor device modeling and fabrication divisions

Microwave Semiconductor Devices Sigfrid Yngvesson, 1991-06-30 We have reached the double conclusion that invention is choice that this choice is imperatively governed by the sense of scientific beauty Hadamard 1945 Princeton University Press by permission The great majority of all sources and amplifiers of microwave energy and all devices for receiving or detecting microwaves use a semiconductor active element The development of microwave semiconductor devices described in this book has proceeded from the simpler two terminal devices such as GUNN or IMPATT devices which originated in the 1960s to the sophisticated monolithic circuit MESFET three terminal active elements of the 1980s and 1990s The microwave field has experienced a renaissance in electrical engineering departments in the last few years and much of this growth has been associated with microwave semiconductor devices The University of Massachusetts has recently developed a well recognized program in microwave engineering Much of the momentum for this program has been provided by interaction with industrial companies and the influx of a large number of industry supported students This program had a need for a course in microwave semiconductor devices which covered the physical aspects as well as the aspects of interest to the engineer who incorporates such devices in his designs It was also felt that it would be important to introduce the most recently developed devices HFETs HBTs and other advanced devices as early as possible

[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

SEMICONDUCTOR DEVICES DASGUPTA NANDITA, DASGUPTA AMITAVA, 2004-01-01 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

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

Modern Semiconductor Devices for Integrated Circuits Chenming Hu, 2010 For courses in semiconductor devices Prepare your students for the semiconductor device technologies of today and tomorrow Modern Semiconductor Devices for Integrated Circuits First Edition introduces students to the world of modern semiconductor devices with an emphasis on integrated circuit applications Written by an experienced teacher researcher and expert in industry practices this succinct and forward looking text is appropriate for both undergraduate and graduate students and serves as a suitable reference text for practicing engineers

Superconducting

Devices Steven T. Ruggiero, 2013-07-10 Superconducting Devices presents the theory qualification and fabrication of superconducting device elements and integrated circuitry This book discusses the various uses of superconducting devices in many areas where their sensitivity speed or other characteristics stemming from the unique nature of superconductivity make them the device of choice Organized into 10 chapters this book begins with an overview of superconducting quantum interference devices SQUIDS which is the main achievement of superconductor electronics This text then examines the status of dc and rf SQUIDS Other chapters consider the progress in the fabrication technology for high quality junctions and its integration technology which are developed mainly for digital applications This book discusses as well the increasing need for compact submillimeter sources for use in such applications as satellite communications and receivers for astronomical observation The final chapter deals with the thin film tunneling experiments This book is a valuable resource for physicists chemists materials scientists and electrical engineers

The IGBT Device B. Jayant Baliga, 2015-03-06 The IGBT device has proved to be a highly important Power Semiconductor providing the basis for adjustable speed motor drives used in air conditioning and refrigeration and railway locomotives electronic ignition systems for gasolinepowered motor vehicles and energy saving compact fluorescent light bulbs Recent applications include plasma displays flat screen TVs and electric power transmission systems alternative energy systems and energy storage This book is the first available to cover the applications of the IGBT and provide the essential information needed by applications engineers to design new products using the device in sectors including consumer industrial lighting transportation medical and renewable energy The author B Jayant Baliga invented the IGBT in 1980 while working for GE His book will unlock IGBT for a new generation of engineering applications making it essential reading for a wide audience of electrical engineers and design engineers as well as an important publication for semiconductor specialists Essential design information for applications engineers utilizing IGBTs in the consumer industrial lighting transportation medical and renewable energy sectors Readers will learn the methodology for the design of IGBT chips including edge terminations cell topologies gate layouts and integrated current sensors The first book to cover applications of the IGBT a device manufactured around the world by more than a dozen companies with sales exceeding 5 Billion written by the inventor of the device

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

Semiconductor Devices J. J. Sparkes, 1994 Presents semiconductor devices in a clear and concise manner The book serves as an introduction to theoretical principles underlying the operation of semiconductor devices and to their simple and effective mathematical modelling

Physics of Semiconductor Devices Suresh C. Jain, S. Radhakrishna, 1985

Semiconductor Device Modeling with SPICE Paolo Antognetti, Giuseppe Massobrio, 1988 Handbook of Advanced Electronic and Photonic Materials and Devices: Semiconductor devices Hari Singh Nalwa, 2001

Electronic and photonic materials discussed in this handbook are the key elements of continued scientific and technological advances in the 21st century. The electronic and photonic materials comprising this handbook include semiconductors, superconductors, ferroelectrics, liquid crystals, conducting polymers, organic and superconductors, conductors, nonlinear optical and optoelectronic materials, electrochromic materials, laser materials, photoconductors, photovoltaic and electroluminescent materials, dielectric materials, nanostructured materials, supramolecular and self assemblies, silicon and glasses, photosynthetic and respiratory proteins etc etc. Some of these materials have already been used and will be the most important components of the semiconductor and photonic industries: computers, internet, information processing and storage, telecommunications, satellite communications, integrated circuits, photocopiers, solar cells, batteries, light emitting diodes, liquid crystal displays, magneto optic memories, audio and video systems, recordable compact discs, video cameras, X ray technology, color imaging, printing, flat panel displays, optical waveguides, cable televisions, computer chips, molecular sized transistors and switches as well as other emerging cutting edge technologies. Electronic and photonic materials are expected to grow to a trillion dollar industry in the new millennium and will be the most dominating forces in the emerging new technologies in the fields of science and engineering. This handbook is a unique source of the in depth knowledge of synthesis, processing, fabrication, spectroscopy, physical properties and applications of electronic and photonic materials covering everything for today's and developing future technologies. This handbook consists of over one hundred state of the art review chapters written by more than 200 world leading experts from 25 different countries. With more than 23 000 bibliographic citations and several thousands of figures, tables, photographs, chemical structures and equations, this handbook is an invaluable major reference source for scientists and students working in the field of materials science, solid state physics, chemistry, electrical and optical engineering, polymer science, device engineering and computational engineering, photophysics, data storage and information technology and technocrats everyone who is involved in science and engineering of electronic and photonic materials.

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High Voltage and Power

Semiconductor Devices David Giandomenico,1990

Semiconductor Devices and Circuits Henry Zanger,1984

Transient Electro-Thermal Modeling on Power Semiconductor Devices Tanya Kirilova Gachovska, Jerry Hudgins, Bin Du, Enrico Santi, 2022-06-01 This book presents physics based electro thermal models of bipolar power semiconductor devices including their packages and describes their implementation in MATLAB and Simulink It is a continuation of our first book *Modeling of Bipolar Power Semiconductor Devices* The device electrical models are developed by subdividing the devices into different regions and the operations in each region along with the interactions at the interfaces are analyzed using the basic semiconductor physics equations that govern device behavior The Fourier series solution is used to solve the ambipolar diffusion equation in the lightly doped drift region of the devices In addition to the external electrical characteristics internal physical and electrical information such as junction voltages and carrier distribution in different regions of the device can be obtained using the models The instantaneous dissipated power calculated using the electrical device models serves as input to the thermal model RC network with constant and nonconstant thermal resistance and thermal heat capacity or Fourier thermal model of the entire module or package which computes the junction temperature of the device Once an updated junction temperature is calculated the temperature dependent semiconductor material parameters are re calculated and used with the device electrical model in the next time step of the simulation The physics based electro thermal models can be used for optimizing device and package design and also for validating extracted parameters of the devices The thermal model can be used alone for monitoring the junction temperature of a power semiconductor device and the resulting simulation results used as an indicator of the health and reliability of the semiconductor power device

Theory of Modern

Electronic Semiconductor Devices Kevin F. Brennan, April S. Brown, 2002-03-07 A thorough examination of the present and future of semiconductor device technology Engineers continue to develop new electronic semiconductor devices that are almost exponentially smaller faster and more efficient than their immediate predecessors *Theory of Modern Electronic Semiconductor Devices* endeavors to provide an up to date extended discussion of the most important emerging devices and trends in semiconductor technology setting the pace for the next generation of the discipline s literature Kevin Brennan and April Brown focus on three increasingly important areas telecommunications quantum structures and challenges and alternatives to CMOS technology Specifically the text examines the behavior of heterostructure devices for communications systems quantum phenomena that appear in miniaturized structures and new nanoelectronic device types that exploit these effects the challenges faced by continued miniaturization of CMOS devices and futuristic alternatives Device structures on the commercial and research levels analyzed in detail include Heterostructure field effect transistors Bipolar and CMOS transistors Resonant tunneling diodes Real space transfer transistors Quantum dot cellular automata Single electron transistors The book contains many homework exercises at the end of each chapter and a solution manual can be obtained for instructors Emphasizing the development of new technology *Theory of Modern Electronic Semiconductor Devices* is an

ideal companion to electrical and computer engineering graduate level courses and an essential reference for semiconductor device engineers

Semiconductor Devices and Circuits Aloke Dutta, 2008 Semiconductor Devices and Circuits is aimed at undergraduate students of engineering for an introductory course on devices circuits The book covers in detail the basic theories and principles of both devices and circuits Beginning with the fundamental concepts the book gives an exhaustive coverage of topics such as basic semiconductor physics crystal structures junction diode bipolar junction transistor MOS capacitor MOSFET biasing frequency response of amplifiers and operational amplifiers Written in a very lucid and student friendly style the book contains plenty of solved examples interspersed in the text for easy understanding of concepts References have also been given at the end of the book for students interested in further reading of the topics Numerous exercises at the end of each chapter challenge readers to test their understanding of concepts

Physics of Semiconductor Devices Vikram Kumar, S. K. Agarwal, 2000

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