

## An Isolated Gate Drive For Power Mosfets And Igbts

This book explores integrated gate drivers with emphasis on new gallium nitride (GaN) power transistors, which offer fast switching along with minimum switching losses. It serves as a comprehensive, all-in-one source for gate driver IC design, written in handbook style with systematic guidelines. The authors cover the full range from fundamentals to implementation details including topics like power stages, various kinds of gate drivers (resonant, non-resonant, current-source, voltage-source), gate drive schemes, driver supply, gate loop, gate driver power efficiency and comparison silicon versus GaN transistors. Solutions are presented on the system and circuit level for highly integrated gate drivers. Coverage includes miniaturization by higher integration of subfunctions onto the IC (buffer capacitors), as well as more efficient switching by a multi-level approach, which also improves robustness in case of extremely fast switching transitions. The discussion also includes a concept for robust operation in the highly relevant case that the gate driver is placed in distance to the power transistor. All results are widely applicable to achieve highly compact, energy efficient, and cost-effective power electronics solutions.?

Design, Control and Application of Modular Multilevel Converters for HVDC Transmission Systems is a comprehensive guide to semiconductor technologies applicable for MMC design, component sizing control, modulation, and application of the MMC technology for HVDC transmission. Separated into three distinct parts, the first offers an overview of MMC technology, including information on converter component sizing, Control and Communication, Protection and Fault Management, and Generic Modelling and Simulation. The second covers the applications of MMC in offshore WPP, including planning, technical and economic requirements and optimization options, fault management, dynamic and transient stability. Finally, the third chapter explores the applications of MMC in HVDC transmission and Multi Terminal configurations, including Supergrids. Key features: Unique coverage of the offshore application and optimization of MMC-HVDC schemes for the export of offshore wind energy to the mainland. Comprehensive explanation of MMC application in HVDC and MTDC transmission technology. Detailed description of MMC components, control and modulation, different modeling approaches, converter dynamics under steady-state and fault contingencies including application and housing of MMC in HVDC schemes for onshore and offshore. Analysis of DC fault detection and protection technologies, system studies required for the integration of HVDC terminals to offshore wind power plants, and commissioning procedures for onshore and offshore HVDC terminals. A set of self-explanatory simulation models for HVDC test cases is available to download from the companion website. This book provides essential reading for graduate students and researchers, as well as field engineers and professionals who require an in-depth understanding of MMC technology.

Power electronics, which is a rapidly growing area in terms of research and applications, uses modern electronics technology to convert electric power from one form to another, such as ac-dc, dc-dc, dc-ac, and ac-ac with a variable output magnitude and frequency. Power electronics has many applications in our every day life such as air-conditioners, electric cars, sub-way trains, motor drives, renewable energy sources and power supplies for computers. This book covers all aspects of switching devices, converter circuit topologies, control techniques, analytical methods and some examples of their applications. \* 25% new content \* Reorganized and revised into 8 sections comprising 43 chapters \* Coverage of numerous applications, including uninterruptable power supplies and automotive electrical systems \* New content in power generation and distribution, including solar power, fuel cells, wind turbines, and flexible transmission

Power Electronics and Motor Drives: Advances and Trends, Second Edition is the perfect resource to keep the electrical engineer up-to-speed on the latest advancements in technologies, equipment and applications. Carefully structured to include both traditional topics for entry-level and more advanced applications for the experienced engineer, this reference sheds light on the rapidly growing field of power electronic operations. New content covers converters, machine models and new control methods such as fuzzy logic and neural network control. This reference will help engineers further understand recent technologies and gain practical understanding with its inclusion of many industrial applications. Further supported by a glossary per chapter, this book gives engineers and researchers a critical reference to learn from real-world examples and make future decisions on power electronic technology and applications. Provides many practical examples of industrial applications Updates on the newest electronic topics with content added on fuzzy logic and neural networks Presents information from an expert with decades of research and industrial experience

\* The first single volume resource for researchers in the field who previously had to depend on separate papers and conference records to attain a working knowledge of the subject. \* Brings together the field's diverse approaches into an integrated and comprehensive theory of PWM

Energy conversion and conditioning technologies, power electronics, adjustable speed drives and their applications, power electronics for the smarter grid, energy efficiency, technologies for sustainable energy systems, converters and power supplies

From Kwame Mbalia and Prince Joel David Makonnen comes an Afrofuturist adventure about a mythical Ethiopian empire. Sci-fi and fantasy combine in this epic journey to the stars. Yared Heywat lives an isolated life in Addis Prime -- a hardscrabble city with rundown tech, lots of rules, and not much to do. His worrywart Uncle Moti and bionic lioness Besa are his only family... and his only friends. Often in trouble for his thrill-seeking antics and wisecracking sense of humor, those same qualities make Yared a star player of the underground augmented reality game, The Hunt for Kaleb's Obelisk. But when a change in the game rules prompts Yared to log in with his real name, it triggers an attack that rocks the city. In the chaos, Uncle Moti disappears. Suddenly, all the stories Yared's uncle told him as a young boy are coming to life, of kingdoms in the sky and city-raiding monsters. And somehow Yared is at the center of them. Together with Besa and the Ibis -- a game rival turned reluctant ally -- Yared must search for his uncle... and answers to his place in a forgotten, galaxy-spanning war.

This is the first comprehensive book which discusses numerous AI applications to electrical machines and drives. It presents a detailed and unified mathematical and physical treatment, and contains many worked examples, presents numerous simulation results and shows a large number of experimental results obtained on different DSP systems. It is essential reading for anyone interested in acquiring a solid background in AI-based electrical machines and drives, including students, teachers and other academics, and an industrial readership.

This book describes high frequency power MOSFET gate driver technologies, including gate drivers for GaN HEMTs, which have great potential in the next generation of switching power converters. Gate drivers serve as a critical role between control and power devices. In recent years, there has been a trend to increase the switching frequency beyond multi-MHz in switching power converters to reduce the passive components and significantly improve power density. However, this results in high switching loss and gate driver loss in power MOSFETs. The novel approach in this book is the proposed Current Source Gate Driver (CSD) including different topologies, control and applications. The CSD can reduce the switching transition time and switching loss significantly, and recover high frequency gate driver loss compared to conventional voltage gate drivers. The basic idea can also be extended to other power devices to improve high frequency switching performance such as SiC MOSFET and IGBT. Topics covered in the book include the state-of-the-art of power MOSFET drive techniques, the switching loss model, current source gate drivers (CSDs), resonant gate drivers, adaptive gate drivers and GaN HEMT gate drivers. The book is essential reading for design engineers, researchers and advanced students working in switching power supplies and in power electronics generally.

Initially, the only electric loads encountered in an automobile were for lighting and the starter motor. Today, demands on performance, safety, emissions, comfort, convenience, entertainment, and communications have seen the working-in of seemingly innumerable advanced electronic devices. Consequently, vehicle electric systems require larger capacities and more complex configurations to deal with these demands. Covering applications in conventional, hybrid-electric, and electric vehicles, the Handbook of Automotive Power Electronics and Motor Drives provides a comprehensive reference for automotive electrical systems. This authoritative handbook features contributions from an outstanding international panel of experts from industry and academia, highlighting existing and emerging technologies. Divided into five parts, the Handbook of Automotive Power Electronics and Motor Drives offers an overview of automotive power systems, discusses semiconductor devices, sensors, and other components, explains different power electronic converters, examines electric machines and associated drives, and details various advanced electrical loads as well as battery technology for automobile applications. As we seek to answer the call for safer, more efficient, and lower-emission vehicles from regulators and consumer insistence on better performance, comfort, and entertainment, the technologies outlined in this book are vital for engineering advanced vehicles that will satisfy these criteria.

High Voltage Isolated Gate Drive for Power Switching Applications 2016 18th European Conference on Power Electronics and Applications (EPE 16 ECCE Europe)

This comprehensive, two-volume resource provides a thorough introduction to lithium ion (Li-ion) technology. Readers get a hands-on understanding of Li-ion technology, are guided through the design and assembly of a battery, through deployment, configuration and testing. The book covers dozens of applications, with solutions for each application provided. Volume Two focuses on small batteries in consumer products and power banks, as well as large low voltage batteries in stationary or mobile house power, telecom, residential, marine and microgrid. Traction batteries, including passenger, industrial, race vehicles, public transit, marine, submarine and aircraft are also discussed. High voltage stationary batteries grid-tied and off-grid are presented, exploring their use in grid quality, arbitrage and back-up, residential, microgrid, industrial, office buildings. Finally, the book explores what happens when accidents occur, so readers may avoid these mistakes. Written by a prominent expert in the field and packed with over 500 illustrations, these volumes contain solutions to practical problems, making it useful for both the novice and experienced practitioners.

The first new biography in twenty years of a beloved New England writer.

This thesis proposes new power converter topologies suitable for aircraft systems. It also proposes both AC-DC and DC-DC types of converters for different electrical loads to improve the performance these systems. To increase fuel efficiency and reduce environmental impacts, less efficient non-electrical aircraft systems are being replaced by electrical systems. However, more electrical systems requires more electrical power to be generated in the aircraft. The increased consumption of electrical power in both civil and military aircrafts has necessitated the use of more efficient electrical power conversion technologies. This book presents a comprehensive mathematical analysis and the design and digital simulation of the power converters. Subsequently it discusses the construction of the hardware prototypes of each converter and the experimental tests carried out to verify the benefits of the proposed solutions in comparison to the existing solutions.

This symposium was the scientific-technical event of the centennial celebration of the Asea Brown Boveri Switzerland. The purpose was to assess the present state of the art as well as shaping the basis for future progress in the area of power devices and related power circuits. The merger of Brown Boveri (BBC) with Asea to Asea Brown Boveri (ABB) three years ago gave new stimulus and enriched the technical substance of the symposium. By 1991, 100 years after the formation of BBC in Switzerland as a single company, this organization has been decentralized, forming 35 independent ABB companies. One of them - ABB Semiconductors Ltd. - directly deals with the power semiconductor business. These significant changes reflect the changes in the market place: increased competition and higher customer expectations have to be fulfilled. In line with the core business activities of ABB and with the concept of sustainable development, it is natural for ABB to be active in the area of power devices and circuits. Increased awareness towards energy conservation is one of the main drives for these activities. User friendliness is another drive: integration of intelligent functions, e.g. protection and/or increased direct computer interfacing of the power circuits. Therefore, also the R&D activities related to the subject of this symposium will in the future be characterized by an even stronger coupling with the market needs. For the members of the R&D Laboratories this means improved customer partnership beyond operational excellence.

Despite two decades of massive strides in research and development on control strategies and their subsequent implementation, most books on permanent magnet motor drives still focus primarily on motor design, providing only elementary coverage of control and converters. Addressing that gap with information that has largely been disseminated only in journals and at conferences, Permanent Magnet Synchronous and Brushless DC Motor Drives is a long-awaited comprehensive overview of power electronic converters for permanent magnet synchronous machines and control strategies for variable-speed operation. It introduces machines, power devices, inverters, and control, and addresses modeling, implementation, control strategies, and flux weakening operations, as well as parameter sensitivity, and rotor position sensorless control. Suitable for both industrial and academic audiences, this book also covers the simulation, low cost inverter topologies, and commutation torque ripple of PM brushless DC motor drives. Simulation of the motor drives system is illustrated with MATLAB® codes in the text. This book is divided into three parts—fundamentals of PM synchronous and brushless dc machines, power devices, inverters; PM synchronous motor drives, and brushless dc motor drives. With regard to the power electronics associated with these drive systems, the author: Explores use of the standard three-phase bridge inverter for driving the machine, power factor correction, and inverter control Introduces space vector modulation step by step and contrasts with PWM Details dead time effects in the inverter, and its compensation Discusses new power converter topologies being considered for low-cost drive systems in PM brushless DC motor drives This reference is dedicated exclusively to PM ac machines, with a timely emphasis on control and standard, and low-cost converter topologies. Widely used for teaching at the doctoral level and for industrial audiences both in the U.S. and abroad, it will be a welcome addition to any engineer's library.

This book provides innovative ideas on achieving sustainable development and using green technologies to conserve our ecosystem. Innovation is the successful exploitation of a new idea. Through innovation, we can achieve MORE while using LESS. Innovations in science & technology will not only help mankind as a whole, but also contribute to the economic growth of individual countries. It is essential that the global problem of environmental degradation be addressed immediately, and thus, we need to rethink the concept of sustainable development. Indeed, new environmentally friendly technologies are fundamental to attaining sustainable development. The book shares a wealth of innovative green technological ideas on how to preserve and improve the quality of the environment, and how to establish a more resource-efficient and sustainable society. The book provides an interdisciplinary approach to addressing various technical issues and capitalizing on advances in computing & optimization for scientific & technological development, smart information, communication, bio-monitoring, smart cities, food quality assessment, waste management, environmental aspects, alternative energies, sustainable infrastructure development, etc. In short, it offers valuable information and insights for budding engineers, researchers, upcoming young minds and industry professionals, promoting awareness for recent advances in the various fields mentioned above.

APEC focuses on the practical and applied aspects of the power electronics business The conference addresses issues of immediate and long term importance to practicing power electronics engineer

A thoroughly revised third edition of this widely praised, bestselling textbook presents a comprehensive systems-level perspective of electric and hybrid vehicles with emphasis on technical aspects,

mathematical relationships and basic design guidelines. The emerging technologies of electric vehicles require the dedication of current and future engineers, so the target audience for the book is the young professionals and students in engineering eager to learn about the area. The book is concise and clear, its mathematics are kept to a necessary minimum and it contains a well-balanced set of contents of the complex technology. Engineers of multiple disciplines can either get a broader overview or explore in depth a particular aspect of electric or hybrid vehicles. Additions in the third edition include simulation-based design analysis of electric and hybrid vehicles and their powertrain components, particularly that of traction inverters, electric machines and motor drives. The technology trends to incorporate wide bandgap power electronics and reduced rare-earth permanent magnet electric machines in the powertrain components have been highlighted. Charging stations are a critical component for the electric vehicle infrastructure, and hence, a chapter on vehicle interactions with the power grid has been added. Autonomous driving is another emerging technology, and a chapter is included describing the autonomous driving system architecture and the hardware and software needs for such systems. The platform has been set in this book for system-level simulations to develop models using various softwares used in academia and industry, such as MATLAB®/Simulink, PLECS, PSIM, Motor-CAD and Altair Flux. Examples and simulation results are provided in this edition using these software tools. The third edition is a timely revision and contribution to the field of electric vehicles that has reached recently notable markets in a more and more environmentally sensitive world.

Electrification is an evolving paradigm shift in the transportation industry toward more efficient, higher performance, safer, smarter, and more reliable vehicles. There is in fact a clear trend to move from internal combustion engines (ICEs) to more integrated electrified powertrains. Providing a detailed overview of this growing area, *Advanced Electric Drive Vehicles* begins with an introduction to the automotive industry, an explanation of the need for electrification, and a presentation of the fundamentals of conventional vehicles and ICEs. It then proceeds to address the major components of electrified vehicles—i.e., power electronic converters, electric machines, electric motor controllers, and energy storage systems. This comprehensive work: Covers more electric vehicles (MEVs), hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), range-extended electric vehicles (REEVs), and all-electric vehicles (EVs) including battery electric vehicles (BEVs) and fuel cell vehicles (FCVs) Describes the electrification technologies applied to nonpropulsion loads, such as power steering and air-conditioning systems Discusses hybrid battery/ultra-capacitor energy storage systems, as well as 48-V electrification and belt-driven starter generator systems Considers vehicle-to-grid (V2G) interface and electrical infrastructure issues, energy management, and optimization in advanced electric drive vehicles Contains numerous illustrations, practical examples, case studies, and challenging questions and problems throughout to ensure a solid understanding of key concepts and applications *Advanced Electric Drive Vehicles* makes an ideal textbook for senior-level undergraduate or graduate engineering courses and a user-friendly reference for researchers, engineers, managers, and other professionals interested in transportation electrification.

APEC focuses on the practical and applied aspects of the power electronics business Not just a power designer s conference, APEC has something of interest for anyone involved in power electronics including Equipment OEMs that use power supplies and converters in their equipment, Designers of power supplies, dc, dc converters, motor drives, uninterruptable power supplies, inverters and any other power electronic circuits, equipments and systems, Manufacturers and suppliers of components and assemblies used in power electronics, manufacturing, quality and test engineers involved with power electronics equipment, Marketing, sales and anyone involved in the business of power electronic, Compliance engineers testing and qualifying power electronics equipment or equipment that uses power electronics

Authored by a team of acknowledged experts, this book presents a multidisciplinary view of the state of the art in the field of actuators. The goal of the book is to provide a comprehensive overview of the properties, applications, and potential applications of traditional and unconventional actuators, together with their corresponding power electronics. Special attention is paid to the objective assessment of competing actuator principles. The book is written primarily for designers and engineers in research and development, but will also be valuable as a textbook for students of automation engineering, mechatronics and adaptronics.

I May observed that recent developments in power electronics have proceeded in two different directions,namely,low power range power supplies using high frequency PWM technique and medium to high power range energy control systems to serve specific Purpose.

SiC and GaN devices have been around for some time. The first dedicated international conference on SiC and related devices, "ICSCRM," was held in Washington, DC, in 1987. But only recently, the commercialization of SiC and GaN devices has happened. Due to its material properties, Si as a semiconductor has limitations in high-temperature, high-voltage, and high-frequency regimes. With the help of SiC and GaN devices, it is possible to realize more efficient power systems. Devices manufactured from SiC and GaN have already been impacting different areas with their ability to outperform Si devices. Some of the examples are the telecommunications, automotive/locomotive, power, and renewable energy industries. To achieve the carbon emission targets set by different countries, it is inevitable to use these new technologies. This book attempts to cover all the important facets related to wide bandgap semiconductor technology, including new challenges posed by it. This book is intended for graduate students, researchers, engineers, and technology experts who have been working in the exciting fields of SiC and GaN power devices.

MEMS devices are found in many of today's electronic devices and systems, from air-bag sensors in cars to smart phones, embedded systems, etc. Increasingly, the reduction in dimensions has led to nanometer-scale devices, called NEMS. The plethora of applications on the commercial market speaks for itself, and especially for the highly precise manufacturing of silicon-based MEMS and NEMS. While this is a tremendous achievement, silicon as a material has some drawbacks, mainly in the area of mechanical fatigue and thermal properties. Silicon carbide (SiC), a well-known wide-bandgap semiconductor whose adoption in commercial products is experiencing exponential growth, especially in the power electronics arena. While SiC MEMS have been around for decades, in this Special Issue we seek to capture both an overview of the devices that have been demonstrated to date, as well as bring new technologies and progress in the MEMS processing area to the forefront. Thus, this Special Issue seeks to showcase research papers, short communications, and review articles that focus on: (1) novel designs, fabrication, control, and modeling of SiC MEMS and NEMS based on all kinds of actuation mechanisms; and (2) new developments in applying SiC MEMS and NEMS in consumer electronics, optical communications, industry, medicine, agriculture, space, and defense. This textbook, designed for undergraduate students of electrical engineering, offers a comprehensive and accessible introduction to state-of-the-art power semiconductor devices

and power electronic converters with an emphasis on design, analysis and realization of numerous types of systems. Each topic is discussed in sufficient depth to expose the fundamental principles, concepts, techniques, methods and circuits, necessary to thoroughly understand power electronic systems.

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 gasoline-powered 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.

This is the clear guide for non-specialists to electromagnetic compatibility (EMC), the effects of electromagnetic radiation and the European EMC Directive which is now in force. This book helps by explaining the basic principles of EMC, how it may be controlled in practice through filtering, shielding, appropriate printed circuit board design, and other means. Electrostatic discharge (ESD) and surge protection are discussed. The growing concern about the effects of electromagnetic waves and fields on health are examined in detail. This introduction provides beginners, technical and non-technical alike with a basic guide to the principles of EMC. This will prove essential reading for the thousands of people close to despair, giving them the underlying insight, in clear words, that is needed to comply with the EMC Directive, and therefore opens the door to continued trading in Europe and the World. Beginner's guide to EMC ideal for non-technical staff Vital for all businesses who export to either Europe or the rest of the world

An up-to-date, practical guide on upgrading from silicon to GaN, and how to use GaN transistors in power conversion systems design This updated, third edition of a popular book on GaN transistors for efficient power conversion has been substantially expanded to keep students and practicing power conversion engineers ahead of the learning curve in GaN technology advancements. Acknowledging that GaN transistors are not one-to-one replacements for the current MOSFET technology, this book serves as a practical guide for understanding basic GaN transistor construction, characteristics, and applications. Included are discussions on the fundamental physics of these power semiconductors, layout, and other circuit design considerations, as well as specific application examples demonstrating design techniques when employing GaN devices. GaN Transistors for Efficient Power Conversion, 3rd Edition brings key updates to the chapters of Driving GaN Transistors; Modeling, Simulation, and Measurement of GaN Transistors; DC-DC Power Conversion; Envelope Tracking; and Highly Resonant Wireless Energy Transfer. It also offers new chapters on Thermal Management, Multilevel Converters, and Lidar, and revises many others throughout. Written by leaders in the power semiconductor field and industry pioneers in GaN power transistor technology and applications Updated with 35% new material, including three new chapters on Thermal Management, Multilevel Converters, Wireless Power, and Lidar Features practical guidance on formulating specific circuit designs when constructing power conversion systems using GaN transistors A valuable resource for professional engineers, systems designers, and electrical engineering students who need to fully understand the state-of-the-art GaN Transistors for Efficient Power Conversion, 3rd Edition is an essential learning tool and reference guide that enables power conversion engineers to design energy-efficient, smaller, and more cost-effective products using GaN transistors.

The book provides a comprehensive overview of Single-Inductor Multiple-Output Converters from both theoretical and practical perspectives. Based on the authors' in-depth research, the volume covers not only conventional SIMO DC-DC converters but also the new generations of SIMO such as SIMO AC-DC converters, SIMO DC-AC converters (or SIMO inverters), and the latest SIMO hybrid converters. This book offers a holistic and systematic presentation of all types of SIMO converters, encompassing the derivation of the circuit topologies, the definition of key concepts, detailed discussion of theoretical underpinnings, design methodology and control schemes, as well as design considerations and techniques that enable practical implementation. Specific examples of real-world applications of SIMO converters are also provided. The volume offers a comprehensive overview and systematic classification of the traditional and modern topologies of SIMO converters in terms of system architecture, circuit analysis, operating principles, control methods, design considerations and practical implementation. Specifically, the book presents the mathematical models and design principles necessary for analyzing the behavior of each kind of SIMO converter, and building upon that, introduces and imparts new approaches and techniques when designing such converters, guiding engineering students and power engineers towards achieving low-cost, compact and energy efficient SIMO converters. offers the design considerations and optimization as well as describing the key applications of SIMO converters. The book fills a significant niche in the power electronics literature and provides a complete perspective on SIMO converters that hopefully can inspire appreciation and better understanding of the subject matter. It can be directly adopted in undergraduate or graduate coursework as well as postgraduate research programs.

Offering in-depth coverage of hybrid propulsion topics, energy storage systems and modelling, and supporting electrical systems, this book will be an invaluable resource for practising engineers and managers involved in all aspects of hybrid vehicle development, modelling, simulation and testing.

