

PRACTICAL SWITCHING POWER SUPPLY DESIGN



Marty Brown



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Series in Solid State Electronics

Practical Switching Power Supply Design

Marty Brown



Practical Switching Power Supply Design:

Practical Switching Power Supply Design Marty Brown, 1990-03-28 Why use switching power supplies How a switching power supply works A walk through a representative switching power supply Switching power supply topologies Semiconductors used in a switching power supply The magnetic components within a switching power supply Cross regulation of the outputs Protection Miscellaneous topics Closing the loop feedback and stability Resonant converters an introduction Switching power supply design examples

Switching Power Supply Design Lazar Rozenblat, 2021-12-27 This handbook provides in a single place the essential information needed in the practical switching mode power supply SMPS design in an easy to use format It may be as useful to the experienced designer as it will to the recent engineering grad a student and a hobbyist The key covered topics Main practically used isolated and non isolated converter topologies including active PFC Power transformer and inductor design and estimation of the losses Feedback control loop relationships including transfer function with TL431 Miscellaneous design and analysis topics such as MOSFET switching time and losses capacitance calculation for transient response PCB trace characteristics and little known empirical equations The covered converter topologies are Buck Fly Buck TM Boost Buck boost non isolated flyback SEPIC CCM and DCM isolated flyback Forward including active clamp forward Half bridge Phase shifted full bridge with current doubler LLC CCM and DCM PFC boost For each covered topology the book provides power plant diagram brief operation principal basic waveforms DC transfer function with efficiency factor voltage and current stresses in switches and rectifiers magnetics equations DC and AC components of the currents in all coils and often overlooked RMS currents in input and output capacitors The analysis is provided for worst case input voltage Note that this is not a textbook for learning power electronics This handbook is for those who know the electronics basics and need a quick reference and practical engineering equations It should speed up your design by saving time that would otherwise be spent on deriving equations and searching the literature not to mention on re spinning the board because of incorrectly selected magnetics underrated components or improperly sized PCB traces

Power Supply Cookbook Marty Brown, 2001-06-13 Power Supply Cookbook Second Edition provides an easy to follow step by step design framework for a wide variety of power supplies With this book anyone with a basic knowledge of electronics can create a very complicated power supply design in less than one day With the common industry design approaches presented in each section this unique book allows the reader to design linear switching and quasi resonant switching power supplies in an organized fashion Formerly complicated design topics such as magnetics feedback loop compensation design and EMI RFI control are all described in simple language and design steps This book also details easy to modify design examples that provide the reader with a design template useful for creating a variety of power supplies This newly revised edition is a practical start to finish design reference It is organized to allow both seasoned and inexperienced engineers to quickly find and apply the information they need Features of the new edition include updated information on the design of

the output stages selecting the controller IC and other functions associated with power supplies such as switching power supply control synchronization of the power supply to an external source input low voltage inhibitors loss of power signals output voltage shut down major current loops and paralleling filter capacitors It also offers coverage of waveshaping techniques major loss reduction techniques snubbers and quasi resonant converters Guides engineers through a step by step design framework for a wide variety of power supplies many of which can be designed in less than one day Provides easy to understand information about often complicated topics making power supply design a much more accessible and enjoyable process

Switching Power Supply Design & Optimization Sanjaya Maniktala, 2005 This is a rigorous carefully explained and motivated beginner's bible to power supply design Between dense mathematical textbooks on power electronics and tiny power supply cookbooks there exists no practical tutorial on the hazards of contemporary power supply design Our Pressman book the 800 lb gorilla in the field is both mathematically dense and 7 years old This new book detailing cutting edge thermal management techniques grouping key design equations in a special reference section and containing a concise Design FAQ will serve both as an invaluable tutorial and quick reference

Switching Power Supply Design Lazar Rozenblat Rozenblat (author), 1901

Switching Power Supply Design and Optimization, Second Edition Sanjaya Maniktala, 2013-10-30 The latest techniques for designing state of the art power supplies including resonant LLC converters Extensively revised throughout Switching Power Supply Design Optimization Second Edition explains how to design reliable high performance switching power supplies for today's cutting edge electronics The book covers modern topologies and converters and features new information on designing or selecting bandgap references transformer design using detailed new design charts for proximity effects Buck efficiency loss teardown diagrams active reset techniques topology morphology and a meticulous AC DC front end design procedure This updated resource contains design charts and numerical examples for comprehensive feedback loop design including TL431 plus the world's first top down simplified design methodology for wide input resonant LLC converters A step by step comparative design procedure for Forward and Flyback converters is also included in this practical guide The new edition covers Voltage references DC DC converters topologies to configurations Contemporary converters composites and related techniques Discontinuous conduction mode Comprehensive front end design in AC DC power conversion Topologies for AC DC applications Tapped inductor autotransformer based converters Selecting inductors for DC DC converters Flyback and Forward converter transformer design Forward and Flyback converters step by step design and comparison PCBs and thermal management Closing the loop feedback and stability including TL431 Practical EMI filter design Reset techniques in Flyback and Forward converters Reliability testing and safety issues Unraveling and optimizing Buck converter efficiency Introduction to soft switching and detailed LLC converter design methodology with PSpice simulations Practical circuits design ideas and component FAQs

Optimal Design of Switching Power Supply Zhanyou Sha, Xiaojun Wang, Yanpeng Wang, Hongtao Ma, 2015-06-15 A contemporary evaluation of switching power design methods

with real world applications Written by a leading author renowned in his field Focuses on switching power supply design manufacture and debugging Switching power supplies have relevance for contemporary applications including mobile phone chargers laptops and PCs Based on the authors successful Switching Power Optimized Design 2nd Edition in Chinese Highly illustrated with design examples of real world applications

Modern Component Families and Circuit Block Design Nihal Kularatna, 2000-03-02 Modern Component Families and Circuit Block Design gathers and summarizes this material in a single volume and also provides a designer's viewpoint on modern components This book provides a practical approach to design problems rather than a generic analysis of broad engineering issues **BOOK JACKET**

Power Sources and Supplies: World Class Designs Marty Brown, 2011-04-08 Newnes has worked with Marty Brown a leader in the field of power design to select the very best design specific material from the Newnes portfolio Marty selected material for its timelessness its relevance to current power supply design needs and its real world approach to design issues Special attention is given to switching power supplies and their design issues including component selection minimization of EMI toroid selection and breadboarding of designs Emphasis is also placed on design strategies for power supplies including case histories and design examples This is a book that belongs on the workbench of every power supply designer Marty Brown author and power supply design consultant has personally selected all content for its relevance and usefulness Covers best design practices for switching power supplies and power converters Emphasis is on pragmatic solutions to commonly encountered design problems and tasks

Practical Design of Power Supplies Ron Lenk, 1998 Practical Design of Power Supplies details key techniques and offers advice to engineers and technicians who want to design and build power supplies that work the first time they are turned on Leading authority Ron Lenk presents current experiment based information that can save hours of research and design time Containing many handy Practical Notes and real world examples Practical Design of Power Supplies is an excellent how to reference to keep by your side throughout the design lab and production phases Practical Design of Power Supplies will be especially useful to designers who need to understand and implement the concepts behind loop compensation and magnetics design

Modern Communications Receiver Design and Technology Cornell Drentea, 2010 This comprehensive sourcebook thoroughly explores the state of the art in communications receivers providing detailed practical guidance for constructing an actual high dynamic range receiver from system design to packaging You also find clear explanations of the technical underpinnings that you need to understand for your work in the field This cutting edge reference presents the latest information on modern superheterodyne receivers dynamic range mixers oscillators complex coherent synthesizers automatic gain control DSP and software radios You find in depth discussions on system design including coverage of all pertinent data and tools Moreover the book offers you a solid understanding of packaging and mechanical considerations as well as a look at tomorrow's receiver technology including new Bragg cell applications for ultra wideband electronic warfare receivers This one stop resource is packed with over 300 illustrations that support

critical topics throughout Troubleshooting Switching Power Converters Sanjaya Maniktala, 2011-04-08 Power Supply design is all about detail And a large part of that detail lies in the practical domain largely because of the typically small number of microseconds of switching periods involved and the even smaller tens of nanoseconds of switch transition times all these in effect accentuating various second order effects that eventually end up playing prime havoc with normal expectations of how the circuit should behave So not unsurprisingly even after reading several books most readers still find themselves no closer to the ultimate goal of designing an actual power supply Sooner or later all engineers start realizing the hard fact that designing a switching power supply isn't the trivial task it once seemed to be But even after years of successfully mastering the underlying theory the ultimate goal of creating a cost effective reliable and commercially viable power supply may still remain a distant dream since success ultimately hinges on experience That is in fact what clearly differentiates a senior and seasoned power supply engineer from the others the ability to navigate and surmount a veritable minefield of tricky issues that can only be learned the hard way by actual hands on experience on the job This book presents practical knowledge the author acquired rather painfully while working in the trenches for several years in major engineering companies scattered across several continents This is intended to be the mythical senior engineer's bag of tricks finally made available in the form of an easy to read book on your shelf This book will make life for the ambitious power supply engineer much simpler besides reducing significantly the rigorous requirement of having to be a senior engineer's protégé for years on end just to gain a small measure of real success in this field A practical presentation that answers the important question why is my switching converter behaving so differently than what I was expecting on the basis of my paper design And how do I bridge that huge gap For the first time a systematic and thorough discussion of troubleshooting switching power supplies Coverage of AC DC and DC DC power supplies Bench Evaluation of semiconductor ICs used in power conversion describing standard and unusual techniques mastered by the author while testing similar chips at National Semiconductor Detailed coverage of vital topics that haven't been covered by available sources grounding systems the subtleties of component datasheets and using instruments and probes effectively Systematic investigation type of failure mechanism topology etc and solutions for 5 years of reported power supply issues on a prominent public web forum This approach will ensure that engineers will not repeat the same mistakes A unique readable style personal and direct no mystification just the plain truth easily and logically explained with plenty of pictures graphs and plots Switchmode Power Supply Handbook Keith Billings, 1999 Unarguably the leading hands on guide in this rapidly expanding area of electronics Keith Billings new revision of his Switchmode Power Supply Handbook brings state of the art techniques and developments to engineers at all levels Offering sound working knowledge of the latest in topologies and clear step by step approaches to component decisions this Handbook gives power supply designers practical solutions oriented design guidance free of unnecessarily complicated mathematical derivations and theory This thoroughly updated Handbook features many

new fully worked examples as well as numerous nomograms everything you need to design today's smaller faster and cooler systems Turn to just about any page and you'll find cutting edge design expertise on electronic ballast power factor correction new thermal management techniques transformers chokes input filters EMI control converters snubber circuits auxiliary systems and much more The most comprehensive book on power supply design available anywhere Switchmode Power Supply Handbook is the industry standard now fully updated for the 21st century

Switching Power Supplies A - Z Sanjaya Maniktala, 2012-04-04 Chapter 1 The Principles of Switching Power Conversion Chapter 2 DC DC Converter Design and Magnetics Chapter 3 Off line Converter Design and Magnetics Chapter 4 The Topology FAQ Chapter 5 Optimal Core Selection Chapter 6 Component Ratings Stresses Reliability and Life Chapter 7 Optimal Power Components Selection Chapter 8 Conduction and Switching Losses Chapter 9 Discovering New Topologies Chapter 10 Printed Circuit Board Layout Chapter 11 Thermal Management Chapter 12 Feedback Loop Analysis and Stability Chapter 13 Paralleling Interleaving and Sharing Chapter 14 The Front End of AC DC Power Supplies Chapter 15 DM and CM Noise in Switching Power Supplies Chapter 16 Fixing EMI across the Board Chapter 17 Input Capacitor and Stability Chapter 18 The Math behind the Electromagnetic Puzzle Chapter 19 Solved Examples Appendix A

Energy Storage Systems in Electronics Tetsuya Osaka, Madhav Datta, 2000-05-30 This volume illustrates the technological advances made in recent years in the development of battery and other energy storage systems Discussions of present and near future battery technologies are included as well as emerging energy technologies that have the potential to impact on the portable electronics industry in the long term This text provides a complete overview of the technology status and trends with a focus on scientific developments particularly in materials that have led to technological breakthroughs

Switchmode Power Supply Handbook 3/E Keith Billings, Taylor Morey, 2010-10-06 The definitive guide to switchmode power supply design fully updated Covering the latest developments and techniques Switchmode Power Supply Handbook third edition is a thorough revision of the industry leading resource for power supply designers New design methods required for powering small high performance electronic devices are presented Based on the authors decades of experience the book is filled with real world solutions and many nomograms and features simplified theory and mathematical analysis This comprehensive volume explains common requirements for direct operation from the AC line supply and discusses design theory and practice Engineering requirements of switchmode systems and recommendations for active power factor correction are included This practical guide provides you with a working knowledge of the latest topologies along with step by step approaches to component decisions to achieve reliable and cost effective power supply designs Switchmode Power Supply Handbook third edition covers Functional requirements of direct off line switchmode power supplies Power components selection and transformer designs for converter circuits Transformer choke and thermal design Input filters RFI control snubber circuits and auxiliary systems Active power factor correction system design Worked examples of would components Examples of fully resonant and quasi resonant systems A resonant

inverter fluorescent ballast An example of high power phase shift modulated system A new MOSFET resonant inverter drive scheme A single control wide range wave oscillator Power Electronics Design Handbook Nihal Kularatna,1998 Power Electronics Design Handbook covers the basics of power electronics theory and components while emphasizing modern low power components and applications Coverage includes power semiconductors converters power supplies batteries protection systems and power ICs One of the unique features of the Power Electronics Design Handbook is the integration of component and system theory with practical applications particularly energy saving low power applications Many chapters also include a section that looks forward to future developments in that area References for further information or more in depth technical reading are also included Nihal Kularatna is a principal research engineer with the Arthur C Clarke Foundation in Sri Lanka He is also the author of Modern Electronic Test and Measuring Instruments published by the Institute of Electrical Engineers Emphasizes low and medium power components Offers a unique mix of theory and practical application Provides a useful guide to further reading *Switched Mode Power Supplies* H. W. Whittington,Brian W. Flynn,Donald Ewen Macpherson,1997 Switched mode power supplies are now established as an industry standard method of providing power to many types of electronic equipment This book provides thorough up to date coverage of all aspects of switched mode power supply technology Covers the full range of topics associated with the successful design and production of a switched mode power supply Provides a sound rigorous treatment of the theory as well as practical applications to allow the reader to achieve a suitable design and functionally satisfactory switched mode power supply Considerably expanded since the first edition The second edition includes coverage of electromagnetic compatibility the main statutory regulations associated with switched mode power supply production and validated simulation programs Reference Data for Engineers Mac E. Van Valkenburg,2001-09-26 This standard handbook for engineers covers the fundamentals theory and applications of radio electronics computers and communications equipment It provides information on essential need to know topics without heavy emphasis on complicated mathematics It is a must have for every engineer who requires electrical electronics and communications data Featured in this updated version is coverage on intellectual property and patents probability and design antennas power electronics rectifiers power supplies and properties of materials Useful information on units constants and conversion factors active filter design antennas integrated circuits surface acoustic wave design and digital signal processing is also included This work also offers new knowledge in the fields of satellite technology space communication microwave science telecommunication global positioning systems frequency data and radar **Switching Power Supply Design, 3rd Ed.** Abraham Pressman,Keith Billings,Taylor Morey,2009-03-26 The World s 1 Guide to Power Supply Design Now Updated Recognized worldwide as the definitive guide to power supply design for over 25 years Switching Power Supply Design has been updated to cover the latest innovations in technology materials and components This Third Edition presents the basic principles of the most commonly used topologies providing you with the essential

information required to design cutting edge power supplies Using a tutorial how and why approach this expert resource is filled with design examples equations and charts The Third Edition of Switching Power Supply Design features Designs for many of the most useful switching power supply topologies The core principles required to solve day to day design problems A strong focus on the essential basics of transformer and magnetics design New to this edition a full chapter on choke design and optimum drive conditions for modern fast IGBTs Get Everything You Need to Design a Complete Switching Power Supply Fundamental Switching Regulators Push Pull and Forward Converter Topologies Half and Full Bridge Converter Topologies Flyback Converter Topologies Current Mode and Current Fed Topologies Miscellaneous Topologies Transformer and Magnetics Design High Frequency Choke Design Optimum Drive Conditions for Bipolar Power Transistors MOSFETs Power Transistors and IGBTs Drive Circuits for Magnetic Amplifiers Postregulators Turn on Turn off Switching Losses and Low Loss Snubbers Feedback Loop Stabilization Resonant Converter Waveforms Power Factor and Power Factor Correction High Frequency Power Sources for Fluorescent Lamps and Low Input Voltage Regulators for Laptop Computers and Portable Equipment

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