

EDN Series for Design Engineers

Brown	<i>Power Supply Cookbook, Second Edition</i>
Dostál	<i>Operational Amplifiers, Second Edition</i>
Dye	<i>Radio Frequency Transistors: Principles and Practical Applications, Second Edition</i>
Gates Energy Products	<i>Rechargeable Batteries Applications Handbook</i>
Hickman	<i>Electronic Circuits, Systems and Standards: The Best of EDN</i>
Marston	<i>Newnes Electronic Circuits Pocket Book</i>
Marston	<i>Integrated Circuit and Waveform Generator Handbook</i>
Marston	<i>Diode, Transistor and FET Circuits Manual</i>
Pease	<i>Troubleshooting Analog Circuits</i>
Sinclair	<i>Passive Components</i>
Williams	<i>Analog Circuit Design: Art, Science and Personalities</i>


Power Supply Cookbook

Second Edition


Marty Brown



Newnes

 Newnes is an imprint of Butterworth–Heinemann.
Copyright © 2001 by Butterworth–Heinemann
A member of the Reed Elsevier group
All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher.

 Recognizing the importance of preserving what has been written,
Butterworth–Heinemann prints its books on acid-free paper whenever possible.
Butterworth–Heinemann supports the efforts of American Forests and the Global ReLeaf program in its campaign for the betterment of trees, forests, and our environment.

Library of Congress Cataloging-in-Publication Data

Brown, Marty.
Power supply cookbook / Marty Brown.—2nd ed.
p. cm.
Includes bibliographical references and index.
ISBN 0-7506-7329-X
1. Electric power supplies to apparatus—Design and construction.
2. Power electronics. 3. Electronic apparatus and appliances—power supply. I. Title.
TK7868.P6 B76 2001
621.381'044—dc21

00-050054

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

The publisher offers special discounts on bulk orders of this book.

For information, please contact:

Manager of Special Sales
Butterworth–Heinemann
225 Wildwood Avenue
Woburn, MA 01801-2041
Tel: 781-904-2500
Fax: 781-904-2620

For information on all Newnes publications available, contact our World Wide Web home page at: <http://www.newnespress.com>

Contents

Preface ix

Introduction xi

1. The Role of the Power Supply within the System and the Design Program
 - 1.1 *Getting Started. This Journey Starts with the First Question* 1
 - 1.2 *Power System Organization* 2
 - 1.3 *Selecting the Appropriate Power Supply Technology* 3
 - 1.4 *Developing the Power System Design Specification* 5
 - 1.5 *A Generalized Approach to Power Supplies: Introducing the Building-block Approach to Power Supply Design* 8
 - 1.6 *A Comment about Power Supply Design Software* 9
 - 1.7 *Basic Test Equipment Needed* 9

2. An Introduction to the Linear Regulator
 - 2.1 *Basic Linear Regulator Operation* 11
 - 2.2 *General Linear Regulator Considerations* 12
 - 2.3 *Linear Power Supply Design Examples* 14
 - 2.3.1 *Elementary Discrete Linear Regulator Designs* 15
 - 2.3.2 *Basic 3-Terminal Regulator Designs* 15
 - 2.3.3 *Floating Linear Regulators* 18

3. Pulsewidth Modulated Switching Power Supplies
 - 3.1 *The Fundamentals of PWM Switching Power Supplies* 21
 - 3.1.1 *The Forward-mode Converter* 22
 - 3.1.2 *The Boost-mode Converter* 24
 - 3.2 *The Building-block Approach to PWM Switching Power Supply Design* 26
 - 3.3 *Which Topology of PWM Switching Power Supply to Use?* 28
 - 3.4 *The “Black Box” Considerations for Switching Power Supplies* 34
 - 3.5 *Design of the Magnetic Elements* 37
 - 3.5.1 *The Generalized Design Flow of the Magnetic Elements* 37
 - 3.5.2 *Determining the Size of the Magnetic Core* 38
 - 3.5.3 *Designing the Forward-mode Transformer* 40
 - 3.5.4 *Designing the Flyback Transformer* 42
 - 3.5.5 *Designing the Forward-mode Filter Choke* 46
 - 3.5.6 *Designing the Mutually Coupled, Forward-mode Filter Choke* 47
 - 3.5.7 *Designing the dc Filter Choke* 48
 - 3.5.8 *Base and Gate Drive Transformers* 50
 - 3.5.9 *Winding Techniques for Switchmode Transformers* 52
 - 3.6 *The Design of the Output Stages* 56
 - 3.6.1 *The Passive Output Stage* 58

Power Supply Cookbook

Second Edition

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.