

Phase-Shifted Full Bridge DC/DC Power Converter Design Guide



TEXAS INSTRUMENTS

Abstract

The phase shifted full bridge (PSFB) converter is used for DC-DC conversion in various applications, for example in telecom systems to convert a high voltage bus to an intermediate distribution voltage, typically closer to 48V. PSFB stage provides voltage translation as well as isolation from the line voltage, since this topology includes a transformer.

This document presents the implementation details of a digitally controlled PSFB system implemented on the HVPSFB kit from Texas Instruments. This kit converts a 400V DC input to a regulated 12V DC output and is rated for operations up to 600W. Both peak current mode control (PCMC) and voltage mode control (VMC) implementations are described. These highly integrated microcontroller based realizations feature adaptive zero voltage switching (ZVS) and various synchronous rectification schemes, which are discussed here. Details for generating complex gate drive waveforms, required by these control schemes, and intelligent timing control, to optimize system performance under changing operating conditions, are provided. A step by step guide to run and get familiar with the HVPSFB project is also included. A constant high system efficiency above 10% rated load, novel PCMC waveform generation based on on-chip hardware mechanisms, and simple system implementation are the highlights of this solution.

NOTE: If you would like to quickly evaluate this kit without going through the implementation details, please follow the accompanying quick start guide (QSG-HVPSB-Rev1.1.pdf) instead of this document.



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Phase Shifted Full Bridge Dc Dc Power Converter Design Guide

**Krishna Murari, Bhim Singh, Vijay
Kumar Sood**



Phase Shifted Full Bridge Dc Dc Power Converter Design Guide:

Design eines EMV-optimierten HV/NV DC-DC-Wandlers für elektrifizierte Fahrzeuge Achim Vedde, 2025-06-13 Achim Vedde befasst sich mit der Fragestellung wie ein HV NV DC DC Wandler für elektrifizierte Fahrzeuge derart ausgelegt werden kann dass die entstehenden Emissionen minimal sind und der Bauteilaufwand für die notwendige Dämpfung gering ist Der Autor zeigt wie durch ein EMV optimiertes Design des Schaltnetzteils der Filteraufwand zur Reduzierung der Emissionen gering gehalten werden kann Das in dem Buch vorgestellte systematische Filterdesign gestattet die Ableitung eines geeigneten passiven EMV Filters unter Berücksichtigung der Strömpfade wodurch eine Verringerung des Bauteilaufwandes ermöglicht wird Neben der passiven Filterung zeigt Achim Vedde auf wie diese durch eine Integration aktiver Filterelemente unterstützt werden kann

Practical Design Considerations for Isolated DC-DC Converters Alexander Isurin, Mark J. Scott, 2025-08-03 This book is for design engineers building isolated DC DC converters for commercial products It provides guidance and recommendations to help engineers make decisions that prevent mistakes during product development ensure the design process is as predictable as possible create more reliable and cost effective hardware and do their designs in a shorter period The authors focus on converters that operate at 2 kW and above have high conversion ratios and have at least one low voltage terminal that conducts several 100 A s or more These operating characteristics satisfy critical automotive aerospace military manufacturing and telecommunication needs Coverage includes guidelines for successfully using silicon carbide SiC and gallium nitride GaN power devices including techniques for gate drive design printed circuit board layout and failure mechanisms This practical reference manual shows professional engineers how to consider the whole picture of a power conversion system during their design process It is also a valuable guide for researchers and graduate students working in the field of power electronics if supportLists Posits an Engineering Philosophy that focuses on system level considerations rather than component level considerations if supportLists Creates Figure of Merits for comparing power convertors and demonstrates how they are used to develop power conversion systems if supportLists Helps designers avoid common pitfalls during the engineering process

Power Electronics for Electric Vehicles and Energy Storage Dharavath Kishan, Ramani Kannan, B Dastagiri Reddy, Prajof Prabhakaran, 2023-05-16 This text will help readers to gain knowledge about designing power electronic converters and their control for electric vehicles It discusses the ways in which power from electric vehicle batteries is transferred to an electric motor the technology used for charging electric vehicle batteries and energy storage The text covers case studies and real life examples related to electric vehicles The book Discusses the latest advances and developments in the field of electric vehicles Examines the challenges associated with the integration of renewable energy sources with electric vehicles Highlights basic understanding of the charging infrastructure for electric vehicles Covers concepts including the reliability of power converters in electric vehicles and battery management systems This book discusses the challenges emerging technologies and recent development of power electronics for electric vehicles

It will serve as an ideal reference text for graduate students and academic researchers in the fields of electrical engineering electronics and communication engineering environmental engineering automotive engineering and computer science

Electric Powertrain John G. Hayes, G. Abbas Goodarzi, 2017-11-13 The why what and how of the electric vehicle powertrain Empowers engineering professionals and students with the knowledge and skills required to engineer electric vehicle powertrain architectures energy storage systems power electronics converters and electric drives The modern electric powertrain is relatively new for the automotive industry and engineers are challenged with designing affordable efficient and high performance electric powertrains as the industry undergoes a technological evolution Co authored by two electric vehicle EV engineers with decades of experience designing and putting into production all of the powertrain technologies presented this book provides readers with the hands on knowledge skills and expertise they need to rise to that challenge This four part practical guide provides a comprehensive review of battery hybrid and fuel cell EV systems and the associated energy sources power electronics machines and drives Introduces and holistically integrates the key EV powertrain technologies Provides a comprehensive overview of existing and emerging automotive solutions Provides experience based expertise for vehicular and powertrain system and sub system level study design and optimization Presents many examples of powertrain technologies from leading manufacturers Discusses the dc traction machines of the Mars rovers the ultimate EVs from NASA Investigates the environmental motivating factors and impacts of electromobility Presents a structured university teaching stream from introductory undergraduate to postgraduate Includes real world problems and assignments of use to design engineers researchers and students alike Features a companion website with numerous references problems solutions and practical assignments Includes introductory material throughout the book for the general scientific reader Contains essential reading for government regulators and policy makers **Electric Powertrain Energy Systems Power Electronics and Drives for Hybrid Electric and Fuel Cell Vehicles** is an important professional resource for practitioners and researchers in the battery hybrid and fuel cell EV transportation industry The resource is a structured holistic textbook for the teaching of the fundamental theories and applications of energy sources power electronics and electric machines and drives to engineering undergraduate and postgraduate students

Design and Control of Power Converters 2020 Manuel Arias, 2021-06-04 In this book nine papers focusing on different fields of power electronics are gathered all of which are in line with the present trends in research and industry Given the generality of the Special Issue the covered topics range from electrothermal models and losses models in semiconductors and magnetics to converters used in high power applications In this last case the papers address specific problems such as the distortion due to zero current detection or fault investigation using the fast Fourier transform all being focused on analyzing the topologies of high power high density applications such as the dual active bridge or the H bridge multilevel inverter All the papers provide enough insight in the analyzed issues to be used as the starting point of any research Experimental or simulation

results are presented to validate and help with the understanding of the proposed ideas To summarize this book will help the reader to solve specific problems in industrial equipment or to increase their knowledge in specific fields **Smart**

Structures in Energy Infrastructure Anita Khosla,Monika Aggarwal,2021-12-01 This book gathers selected high quality research papers presented at International Conference on Renewable Technologies in Engineering ICRTE 2021 organized by Manav Rachna International Institute of Research Studies Faridabad Haryana India during 15 16 April 2021 The book includes conference papers on the theme Computational Techniques for Renewable Energy Optimization which aims to bring together leading academic scientists researchers and research scholars to exchange and share their experiences and research results on all aspects of renewable energy integration planning control and optimization It also provides a premier interdisciplinary platform for researchers practitioners and educators to present and discuss the most recent innovations trends and concerns as well as practical challenges encountered and solutions adopted in the fields of smart structures in energy infrastructure Proceedings of the 9th International Conference on Computer Engineering and Networks Qi

Liu,Xiaodong Liu,Lang Li,Huiyu Zhou,Hui-Huang Zhao,2020-07-01 This book gathers papers presented at the 9th International Conference on Computer Engineering and Networks CENet2019 held in Changsha China on October 18 20 2019 It examines innovations in the fields of computer engineering and networking and explores important state of the art developments in areas such as Information Security Information Hiding and Cryptography Cyber Security and Intelligent Computing and Applications The book also covers emerging topics in computer engineering and networking along with their applications discusses how to improve productivity by using the latest advanced technologies and examines innovation in the fields of computer engineering and networking particularly in intelligent computing and security Electronic Circuit

Design Nihal Kularatna,2017-12-19 With growing consumer demand for portability and miniaturization in electronics design engineers must concentrate on many additional aspects in their core design The plethora of components that must be considered requires that engineers have a concise understanding of each aspect of the design process in order to prevent bug laden prototypes Electronic Circuit Design allows engineers to understand the total design process and develop prototypes which require little to no debugging before release It provides step by step instruction featuring modern components such as analog and mixed signal blocks in each chapter The book details every aspect of the design process from conceptualization and specification to final implementation and release The text also demonstrates how to utilize device data sheet information and associated application notes to design an electronic system The hybrid nature of electronic system design poses a great challenge to engineers This book equips electronics designers with the practical knowledge and tools needed to develop problem free prototypes that are ready for release **Recent Advances in Power Electronics and**

Drives Krishna Murari,Bhim Singh,Vijay Kumar Sood,2024-03-23 This book entitled Recent Advances in Power Electronics and Drives Select Proceedings of EPREC 2023 provides rigorous discussions case studies and recent developments in the

emerging areas of power electronics especially in power inverters and converters electrical drives regulated power supplies electric vehicle and its charging infrastructure etc The readers would benefit from enhancing their knowledge and skills in the domain areas Also this book may help the readers in developing new and innovative ideas The book can be a valuable reference for beginners researchers and professionals interested in advancements in power electronics and drives **New**

Topologies and Modulation Schemes for Soft-Switching Isolated DC-DC Converters Zhiqiang Guo, Deshang Sha, 2019-09-20 This book presents a series of new topologies and modulation schemes for soft switching in isolated DC DC converters Providing detailed analyses and design procedures for converters used in a broad range of applications it offers a wealth of engineering insights for researchers and students in the field of power electronics as well as stimulating new ideas for future research **Control of Series-Parallel Conversion Systems** Xinbo Ruan, Wu Chen, Tianzhi Fang, Kai

Zhuang, Tao Zhang, Hong Yan, 2018-12-11 Series parallel conversion systems in which multiple standardized converter modules are connected in series or parallel at the input and output sides to meet the demands of various applications This book focuses on the control strategies for the series parallel conversion systems with DC DC converters and DC AC inverters as the basic modules respectively to achieve input voltage current sharing and output voltage current sharing among the constituent modules The detailed theoretical analysis with design examples and experimental validations are presented This book is essential and valuable reference for graduate students and academics majoring in power electronics and engineers engaged in developing DC DC converters DC AC inverters and power electronics transformers **Conducted**

Electromagnetic Interference in Power Converters: Modeling, Prediction and Reduction Xinbo Ruan, Lihong Xie, Qing Ji, Xibo Yuan, 2024-01-12 This book belongs to the subject of electrical engineering It focuses on the modeling prediction and reduction of conducted EMI in power converters including the AC DC rectifiers DC DC converters and DC AC inverters and provides the analytical models and solutions to conducted EMI issues in practical applications The theoretical analysis simulation and experimental results are well presented with figures and tables This book is an essential and valuable reference for the graduate students and academics majoring in power electronics and the engineers being engaged in solving the conducted EMI issues in power converters Senior undergraduate students majoring in electrical engineering and automation engineering also find this book useful **Telecom Power Systems** Dorin O. Neacșu, 2017-12-12 This book

addresses topics specific to the application of power electronics to telecom systems It follows the power flow from national grid down to the last low voltage high current requirement of a processor Auxiliary equipment requirements such as uninterruptible power supplies storage energy systems or charging systems are explained along with peculiar classification or suggestions for usage The presentation of each telecom power system is completed with a large number of practical examples to reinforce new material **Design and Control of Power Converters 2019** Manuel Arias, 2021-07-02 In this

book 20 papers focused on different fields of power electronics are gathered Approximately half of the papers are focused on

different control issues and techniques ranging from the computer aided design of digital compensators to more specific approaches such as fuzzy or sliding control techniques The rest of the papers are focused on the design of novel topologies The fields in which these controls and topologies are applied are varied MMCs photovoltaic systems supercapacitors and traction systems LEDs wireless power transfer etc Microgrids for Commercial Systems Palanisamy

Sivaraman,Chenniappan Sharmeela,Sanjeevikumar Padmanaban,2024-03-19 MICROGRIDS for COMMERCIAL SYSTEMS

This distinct volume provides detailed information on the concepts and applications of the emerging field of microgrids for commercial applications offering solutions in the design installation and operation of this new cutting edge technology The microgrid is defined as Distributed Energy Resources DER and interconnected loads with clearly defined electrical boundaries that act as a single controllable entity concerning the grid as per IEEE standard 2030 7 2017 It provides an uninterrupted power supply to end user loads with high reliability Commercial systems like IT ITES shopping complexes malls the banking sector hospitals etc need an uninterrupted input power supply with high reliability Microgrids are more suitable for commercial systems to service their clients with no service discontinuity The microgrid enables both connection and disconnection from the grid That is the microgrid can operate both in grid connected and islanded modes of operation The microgrid controller plays an important role in microgrid systems It shall have an energy management system and real time control functions that operate in the following conditions both grid connected and islanded modes of operation automatic transfer from grid connected mode to islanding mode reconnection and re synchronization from islanded mode to grid connected mode optimization of both real and reactive power generation and consumption by the energy management system grid support ancillary services etc Whenever a microgrid is in islanded mode it will work as an autonomous system without a distribution grid power supply In this mode of operation fault in the transmission or distribution grid will not propagate into the microgrid Whenever a microgrid operates in grid connected mode power flows bi directionally between the distribution grid and microgrid at the point of interconnection Hence microgrids ensure the uninterrupted power supply to the end user loads with high reliability This book aims to bring together the design installation operation and new research that has been carried out in the field of microgrid applications for commercial power systems **Handbook of Distributed**

Generation Ramesh Bansal,2017-03-07 This book features extensive coverage of all Distributed Energy Generation technologies highlighting the technical environmental and economic aspects of distributed resource integration such as line loss reduction protection control storage power electronics reliability improvement and voltage profile optimization It explains how electric power system planners developers operators designers regulators and policy makers can derive many benefits with increased penetration of distributed generation units into smart distribution networks It further demonstrates how to best realize these benefits via skillful integration of distributed energy sources based upon an understanding of the characteristics of loads and network configuration *Analysis, Optimization and Control of Grid-Interfaced Matrix-Based*

Isolated AC-DC Converters Jaydeep Saha, 2022-11-05 This book presents novel contributions in the development of solid state transformer SST technology both for medium voltage MV and low voltage LV utility grid interfaces which can potentially augment the grid modernization process in the evolving power system paradigm For the MV interface a single stage AC DC SST submodule topology has been proposed and its modulation and soft switching possibilities are analysed experimentally validated and adequately benchmarked A control scheme with power balance capability among submodules is developed for MV grid connected single stage AC DC SST for smooth operation under inevitable parameter drift scenario and experimental validation shows excellent performance under drastic load change conditions A novel machine learning aided multi objective design optimization framework for grid connected SST is developed and experimentally validated which equips a power electronics design engineer with meagre computational resources to find out the most optimal SST design in a convenient time frame This book has also contributed towards the development of dual active bridge DAB type and non DAB type LV grid interfaced isolated AC DC converters by providing solutions to specific topology and modulation related shortcomings in these two types of topologies A comprehensive comparison of the DAB and non DAB type LVAC LVDC converters reveals the superiority of DAB type conversion strategy SiC Technology Maurizio Di Paolo Emilio, 2024-08-13 This essential book offers comprehensive coverage of Silicon Carbide SiC technology including materials manufacturing processes device development and design approaches Authored by leading experts it provides authoritative insights for engineers researchers and enthusiasts Understanding SiC s future impact on technology is crucial making this publication indispensable for those seeking to leverage its transformative potential **High-Frequency Isolated Bidirectional Dual Active Bridge DC-DC Converters with Wide Voltage Gain** Deshang Sha, Guo Xu, 2018-05-17 Written by experts this book is based on recent research findings in high frequency isolated bidirectional DC DC converters with wide voltage range It presents advanced power control methods and new isolated bidirectional DC DC topologies to improve the performance of isolated bidirectional converters Providing valuable insights advanced methods and practical design guides on the DC DC conversion that can be considered in applications such as microgrid bidirectional EV chargers and solid state transformers it is a valuable resource for researchers scientists and engineers in the field of isolated bidirectional DC DC converters **APEC 2002** ,2002

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