

Compensator Study and Implementation for Digital Pulse-Width Modulation System

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ABSTRACT

This thesis describes two PWM controller ICs for switching power converters. They are analog PWM controller IC and digital PWM controller IC. Due to rapid development of CMOS technologies, more and more transistors can be fabricated on a single chip. In these years, the power management ICs such as the highly efficient low-voltage switch-mode DC-DC converters have been applied in consumer electronic products for increasing efficiency and reducing power dissipation. The analog-control scheme for the switching converters is developed for a long time, and it is a very mature technique. Because digital ICs are easier to design than analog ICs, the analog-control scheme designed by digital structures has been discussed in these years. The advantages and disadvantages between these two architectures are treated in this thesis. The key building blocks of analog PWM controller IC are two-stage operational amplifier, voltage-controlled oscillator and hysteretic comparator. The key building blocks of digital PWM controller IC are A/D converter, compensator and digital pulse-width modulation. The analog controller IC and A/D converter have been fabricated with TSMC 0.35um 2P4M 3.3V/5V Mixed Signal CMOS process through CIC. The chip size of the analog controller IC is about 0.35*0.37mm². The chip size of A/D converter is about 0.555*0.555mm². Compensator and digital pulse-width modulation are implemented by Xilinx FPGA Spartan2 chip.

Keywords : compensator ; digital pulse-width modulation ; DC-DC converter

Table of Contents

中文摘要	iv
ABSTRACT	v
Acknowledgment	vi
Contents	vii
List of Figures	ix
List of Tables	xiii
Chapter 1. Introduction	1
1.1 Background	1
1.2 Motivation	4
1.3 Thesis Organization	5
Chapter 2. Fundamental of Switching Regulator	7
2.1 DC-DC Converter	7
2.2 Operational Principle of Buck Converter (Step-Down Converter)	8
2.2.1 Analysis of Buck Converter in the CCM	9
2.2.2 Transition between CCM and DCM	12
2.2.3 Analysis of Buck Converter in the DCM	13
2.2.4 Output Ripple Consideration and Passive Component Selection	17
2.3 Operational Principle of Boost Converter (Step-Up Converter)	18
2.4 Operational Principle of Buck-Boost Converter	20
2.5 Converter Comparison	22
Chapter 3. System Architecture Design	23
3.1 Introduction to PWM	23
3.2 Two Types of Controllers	24
3.2.1 Analog-Control Scheme	26
3.2.2 Digital-Control Scheme	29
Chapter 4. APWM Implementation	35
4.1 Bias Circuit	35
4.1.1 Two-Stage Operational Amplifier	36
4.3 Voltage-Controlled Oscillator	44
4.4 Ramp generator	45
4.5 Hysteretic Comparator	46
4.6 Simulations, Chip Layout and Measurements	52
4.6.1 Simulations of two-stage opamp	53
4.6.2 Simulations of VCO	55
4.6.3 Simulations of Hysteretic Comparator	56
4.6.4 Simulations of PWM	57
4.6.5 Chip Layout of PWM	58
4.6.6 APWM Specifications	59
Chapter 5. DPWM Implementation	60
5.1 8-bit ADC	60
5.2 PI compensator	61
5.3 DPWM	72
5.3 Simulations, Chip Layout and Measurements	73
5.3.1 Simulations of 8-bit ADC	74
5.3.2 Chip Layout of 8-bit ADC	75
5.3.3 8-bit ADC Specifications:	76
5.3.4 Simulations of PI compensator	76
5.3.5 Simulations of DPWM	77
5.4 Comparisons between analog and digital controllers	77
5.4.1 Advantages and Disadvantages of Analog-Control Scheme	78
5.4.2 Advantages and Disadvantages of Digital-Control Scheme	79
Chapter 6. Conclusions	80
6.1 Conclusions	80
6.2 Future Works	80
REFERENCES	81

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