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

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