PWM Controller ICs for DC-DC Converter

鄭文傑、郭永超

E-mail: 9606933@mail.dyu.edu.tw

ABSTRACT

This thesis describes two complete PWM controller IC for switching power converters. One is analog PWM controller IC and another is digital PWM controller IC. Due to rapid development of CMOS technologies, more and more transistors can be fabricated on a single chip. Consumer electronic products also have been developed rapidly in these years. The power management ICs such as the highly efficient low-voltage switch-mode DC-DC converters are mandatory in these devices for maximizing the system run time. The analog-control scheme for the switching converters is developed for a long time, and it is a very mature technique. The digital-control scheme for the switching DC-DC converters also 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 DPWM. These two controller ICs have been fabricated with TSMC 0.35um 2P4M 3.3V/5V Mixed Signal CMOS process through CIC. The chip size of APWM is about 0.35*0.37mm2. The chip size of A/D converter is about 0.555*0.555mm2. The chip size of DPWM is about 0.65*0.56mm2.

Keywords : DC-DC converter ; APWM ; DPWM

Table of Contents

REFERENCES

[1] Cheung Fai Lee and Philip K. T. Mok, Senior Member, " A Monolithic Current – Mode CMOS DC-DC Converter With On-Chip Current-Sensing Technique, " IEEE Journal of Solid-State Circuits, Vol. 39, No. 1, January 2004.

[2] Benjamin J. Patella, Aleksandar Prodic, Art Zirger and Dragan Maksimovic, " High-Frequency Digital PWM Controller IC for DC-DC Converters, " IEEE Transactions on Power Electronics, Vol. 18, No. 1, January 2003.

[3] Asif Syed, Ershad Ahmed and Dragan Maksimovic, “ Digital Pulse Width Modulator Architectures, ” IEEE on Power Electronics Specialists Conference, 2004.
[4] Martin Yeung-Kei Chui, Wing-Hung Ki and Chi-Ying Tsui, “ A Programmable Integrated Digital Controller fore Switching Converters With Dual-Band Switching and Complex Pole-Zero Compensation, ” IEEE Journal of Solid-State Circuits, Vol. 40, No. 3, March 2005.
[5] Angel V. Peterchev, Student Member, IEEE, and Seth R. Sanders, Member, IEEE, “ Quantization Resolution and Limit Cycling in Digitally Controlled PWM Converters, ” IEEE Transactions on Power Electronics, Vol. 18, NO. 1, January 2003.
[6] Mohamed A. Farahat, Fathi. A. Farag and Hamed A. Elsimary, “ Only Digital Technology Analog To Digital Converter Circuit, ” IEEE, 2004.
[7] Roubik Gregorian, “ Introduction to CMOS OP-AMPs and Comparators, ” Wiley, New York, 1999.
[8] Phillip E. Allen and Douglas R. Holberg, “ CMOS Analog Circuit Design, ” Oxford, New York, 2002.
[9] Behzad Razavi, “ Design of Analog CMOS Integrated Circuits, ” McGraw-Hill, 2001.