

ADVANCED INTEGRATED SINGLE-STAGE POWER FACTOR CORRECTION TECHNIQUES

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(ABSTRACT)

This dissertation presents the in-depth study and innovative solutions of the advanced integrated single-stage power-factor-correction (S²PFC) techniques, which target at the low- to medium-level power supplies, for wide range of applications, from power adapters and computers to various communication equipment.

To limit the undesirable power converter input-current-harmonic's impact on the power line and other electronics equipment, stringent current harmonic regulations such as IEC 61000-3-2 have already been enforced. The S²PFC techniques have been proposed and intensively studied, in order to comply these regulations with minimal additional component count and cost.

This dissertation provides a systematic study of the S²PFC input-current-shaping (ICS) mechanism, circuit topology generalization and variation, bulk capacitor voltage stress and switch current stress, converter design and optimization, and evaluation of the state-of-the-art S²PFC techniques with universal-line input.

Besides, this presentation also presents the development of novel S²PFC techniques with a voltage-doubler-rectifier front end to both improve the performance and reduce the cost of S²PFC converters for (international voltage range) universal-line applications. The calculation and experimental results show that the proposed techniques offer a more cost-effective and efficient solution than industries' current practice, with universal-line input and converter power level up to 600 W. Finally, further improved technique is also presented with reduced filter inductor size and increased power density.