

# Preface

Monolithic integration is the paramount trend in both consumer and industrial electronics. In only five decades computers turned from room-filling machines into devices that fit in the palm of our hand. But a computer is only a single example of the large number of electronic devices that surround us in everyday life. The monolithic integration of electronic circuits—i.e. radio-transceivers data-converters complete digital signal-processing systems—has led to a tremendous increase in portability of the state-of-the-art electronic appliances.

But a single building block remains difficult to be integrated in a monolithic electronic system: the switched-mode DC–DC converter. The DC–DC converter provides an interface between the power source—whether it is a battery, a high-voltage DC bus or a loosely regulated supply—and the different voltage rails required in an electronic system. In most cases the switched-mode DC–DC converter is implemented by means of a separate chip, with discrete-type components or a monolithically integrated linear regulator is used instead. Each of these solutions leads to either a bulky, expensive or low power-efficiency solution. This is unacceptable in times where power savings and cost reduction is the governing social paradigm.

Switched-mode DC–DC converters are roughly divided into two categories: the inductive type and the capacitive type. The first using both an inductor and a capacitor to convert the input voltage into a regulated output voltage, the latter using nothing but capacitors to achieve this. In theory inductive-type DC–DC converters provide a lossless DC–DC conversion for a continuous input-output voltage range. Capacitive DC–DC converters fail to meet this expectation. And therefore inductive-type of DC–DC converters are the dominant type of DC–DC conversion apparatus in both commercial and industrial prototypes. For a long time inductive-type DC–DC converters were thought to maintain their superiority even for monolithically integrated prototypes. But in an integrated case the inductive converters are cut short by the poor quality of the integrated inductors, the key-components in the design. Therefore the intuitive preference for inductive converters does not hold anymore. Moreover, integrated capacitors—crucial for the operation of the capacitive converters—are native devices in CMOS technology

and can be constructed at high quality. Therefore, despite their obvious limitations, capacitive DC–DC converters are viable alternatives for the inductive counterparts. But the adoption of monolithic capacitive DC–DC converters requires an extensive analysis of the conversion characteristics. This book describes the background required for designing a fully integrated DC–DC converter in CMOS and provides a detailed discussion of a number of CMOS prototypes.

CMOS Integrated Capacitive DC-DC Converters

Van Breusseger, T.; Steyaert, M.

2013, XIV, 210 p., Hardcover

ISBN: 978-1-4614-4279-0