

# Chapter 1

## Introduction

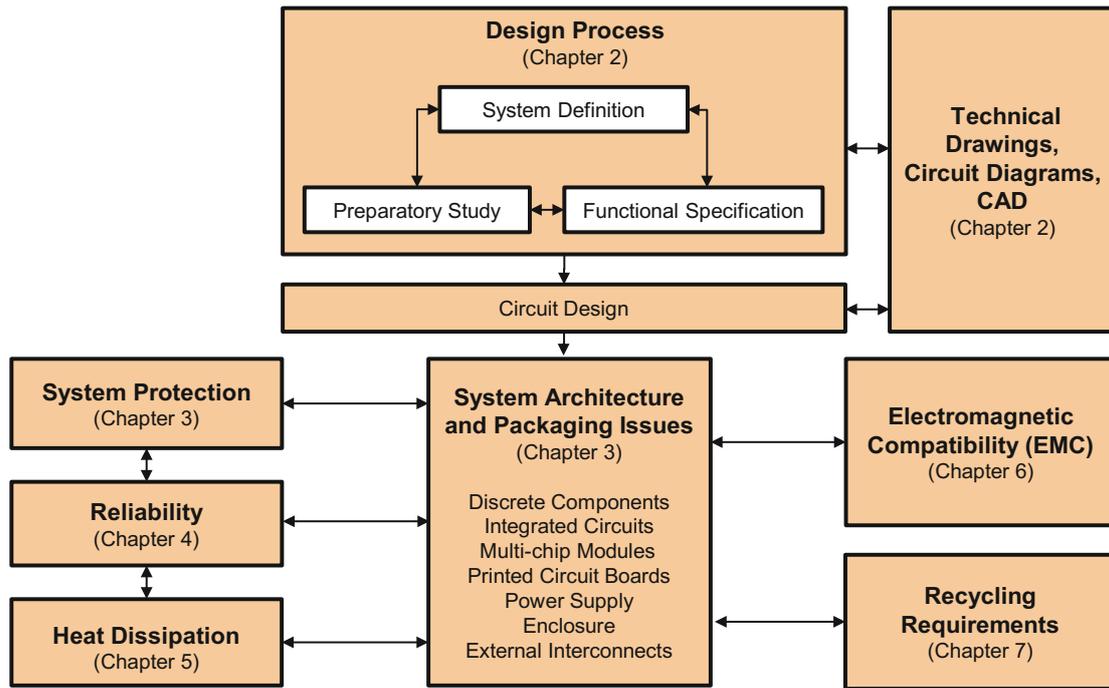
Electronic systems design is the subject within electrical engineering that deals with the multidisciplinary design issues of complex electronic devices, such as smartphones and computers. The subject covers a broad spectrum, from the development of an electronic system to assuring its proper function, service life, and disposal. Major advances in technology, the increasing multidisciplinary nature of the development process and the use of electronic devices in all aspects of our daily lives pose immense challenges for every design engineer.

The book covers all aspects of the development of electronic systems by presenting the theoretical knowledge required for their design and fabrication. This is a discipline that spans electronics, physics, mechanics, and other topics. Designers of electronic circuits, on the one hand, often lack the necessary manufacturing and overall system's expertise, while, on the other hand, (electro-) mechanical designers are hindered in their work by their lack of knowledge of electronic components. This is where this book comes in; it aims to marry the various disciplines involved.

The goal is to convey the knowledge and skills necessary for designing and developing electronic systems and an understanding of the myriad engineering approaches and tasks involved. The reader should learn from the book how to work as a designer and fabricator of these products and acquire the necessary knowledge of all relevant aspects. The key issues encountered in the development of electronic systems are pictured in Fig. 1.1 along with references to the respective chapters in the book.

The principle topics covered are the design process, packaging issues, and associated system levels, extended with special requirements for the development and fabrication of an electronic system. These requirements include protection issues, reliability, thermal management and cooling, shielding, and recyclability. The layout of the book is detailed below:

Chapter 2, *Design Process and its Fundamentals*, presents the steps involved in the design process for electronic systems as well as the use of technical design documentation, such as technical drawings and circuit diagrams. It also provides an introduction to computer-aided design (CAD).



**Fig. 1.1** Requirements for the development of an electronic system and the matching book structure

Different packaging methods for the system-level and for individual components as well as system protection are described in Chap. 3, *System Architecture and Protection Requirements*. Particular emphasis is put on protection classes and IP codes which stipulate how a system should be designed with the protection of persons and the device interior in mind.

Critical reliability parameters and their use are introduced in Chap. 4, *Reliability Analysis*. The reliability requirements for system-level and package design can thus be met and the overall reliability of a system calculated from the known reliabilities of individual components.

Losses and heat transfers associated with components and the overall system are covered in Chap. 5, *Thermal Management and Cooling*. Thermal characteristics can be determined at the design stage and suitable elements selected and deployed for heat dissipation and meeting thermal criteria.

Chapter 6 in the book, *Electromagnetic Compatibility*, deals with EMC issues when designing electronic systems. It also covers conceptual solutions comprising shielding and protection measures against electrostatic discharge (ESD).

Chapter 7, *Recycling Requirements and Design for Environmental Compliance*, presents material that may be new for many engineers and will certainly increase in importance as industry continues to evolve. The chapter describes critical environmental considerations during the design and development stages that have tremendous impact later in the product life cycle, in particular at the tail end during product

disposal and recycling. The challenge for designers in today's waste-disposal-aware society is to produce environmentally compliant systems. Waste and energy consumption should be minimized during manufacture, use, and disposal, and system materials should be fully recyclable after use.

The appendix (Chap. 8) presents rules of technical drawings, preferred numbers (Renard and E-Series) and schematic symbols for electronic components, including their labeling with colors and characters.