

# **Mastering High-speed and Low Power Hardware System Design**

## **Chapter 1: Principles of High-Speed and Low-Power PCB Design**

- 1.1 Fundamentals of PCB design for embedded systems
- 1.2 Trade-offs between speed, power, and thermal constraints
- 1.3 Importance of material selection (FR4, Rogers, etc.)
- 1.4 Design rules for high-speed and low-power circuits

## **Chapter 2: Signal Integrity and High-Speed Routing Techniques**

- 2.1 Transmission line effects, reflections, and impedance matching
- 2.2 PCB stack-up considerations for signal integrity
- 2.3 Controlled impedance routing and differential pairs
- 2.4 Crosstalk mitigation and via optimization

## **Chapter 3: Power Integrity and Efficient Power Delivery Networks**

- 3.1 Power plane design and decoupling capacitor placement
- 3.2 Minimizing IR drop and optimizing current return paths
- 3.3 Low-power voltage regulators and power conversion
- 3.4 PCB layout techniques for reducing power loss

## **Chapter 4: Thermal Management and EMI/EMC Considerations**

- 4.1 Heat dissipation strategies: heatsinks, vias, and copper pours
- 4.2 Managing hot spots in high-speed embedded designs
- 4.3 Shielding and filtering techniques for EMI reduction
- 4.4 Compliance with EMI/EMC regulations

## **Chapter 5: Advanced PCB Design Techniques and Industry Trends**

- 5.1 High-density interconnect (HDI) and multi-layer PCB design
- 5.2 Flexible and rigid-flex PCB technologies
- 5.3 AI-driven PCB design automation and layout tools
- 5.4 Future trends in low-power embedded hardware