

Contents

1	Review of Microelectronics	1
1.1	Introduction	1
1.2	Basic of Semiconductor's Physics	1
1.2.1	PN Junction	3
1.3	Diode	5
1.4	Bipolar Transistor: Emitter Follower	7
1.5	MOS Transistor	11
1.6	Differential Amplifiers	14
1.7	Feedback	16
1.7.1	Effects of Feedback	17
1.7.2	PID Controller	18
1.8	Digital CMOS Circuits	18
1.8.1	CMOS Inverter	19
1.8.2	Example of Circuits	20
1.9	Current Mirror	22
1.9.1	Ideal Current Mirror	22
1.9.2	Current Mirror BJT/MOS	23
	References	24
2	Features of Embedded System	25
2.1	The Components of Embedded System	25
2.1.1	Processor	25
2.1.2	Memory	25
2.1.3	System Clock	26
2.1.4	Peripherals	26
2.2	Characteristics and Example of Embedded System	26
2.3	Hardware and Software Design	29
	References	31

- 3 Microcontroller Design** 33
 - 3.1 Introduction 33
 - 3.2 CPU 35
 - 3.3 Memory 37
 - 3.4 Devices 37
 - 3.4.1 I/O Devices 38
 - 3.5 Power Saving 39
 - 3.6 Instructions 39
 - 3.6.1 Enforcement of Instructions 40
 - 3.7 ARM Architecture 41
 - 3.8 DSP Microprocessor 43
 - 3.8.1 Evaluation Parameters for a DSP 44
 - 3.8.2 Commercial DSP 45
 - 3.9 Microcontroller as Embedded System 46
 - 3.10 FPGA 46
 - References 48

- 4 Design Techniques of Embedded System** 49
 - 4.1 Design 49
 - 4.2 The Waterfall Model 51
 - 4.3 Model V 53
 - 4.4 Architecture 55
 - 4.4.1 ASIC-ASSP 56
 - 4.5 Software 60
 - 4.6 Embedded Linux, Windows, Android 63
 - 4.6.1 Windows Embedded Compact 64
 - 4.6.2 Embedded Linux 64
 - 4.6.3 Embedded Android 65
 - 4.7 Power Management 67
 - 4.7.1 Dynamic Power Management 68
 - 4.7.2 Dynamic Voltage Scaling 69
 - 4.7.3 Latencies 70
 - 4.8 Bus Interface 70
 - 4.8.1 USB and FireWire 72
 - 4.8.2 Standarization and Technical Details of USB Bus 72
 - 4.8.3 Serial Communications 76
 - 4.8.4 Wireless, Ethernet and Bluetooth 77
 - 4.8.5 GSM for Embedded System 79
 - 4.8.6 PCI and PCI Express 80
 - 4.8.7 Compact PCI 81
 - 4.8.8 Zigbee and RFID 85
 - 4.9 Memory 89
 - 4.9.1 Memory Flash 90
 - References 92

- 5 Embedded Development System and C Programming** 93
 - 5.1 Development System 93
 - 5.2 C Programming 94
 - 5.2.1 From Assembly Language to C Language 95
 - 5.2.2 Choose the Right C Compiler 96
 - 5.2.3 ANSI C or C++ 96
 - 5.3 Code Warrior IDE 97
 - 5.4 Commercial Software 99
 - 5.4.1 Labview Embedded 99
 - 5.4.2 Intel Studio 99
 - 5.4.3 Altera 99
 - 5.4.4 IAR Embedded Workbench 99
 - References 100

- 6 Real Time Operating System (RTOS)** 101
 - 6.1 Operating System 101
 - 6.1.1 Classification of Operating Systems 103
 - 6.2 Real Time Software 104
 - 6.3 Examples of Real-Time Embedded Systems 106
 - 6.4 Scheduling 108
 - 6.5 Scheduler Based on Deadline 109
 - 6.6 RTOS for Multicore 109
 - 6.7 RTOS and Application Specific Processors 110
 - 6.8 An RTOS for Complex Systems 110
 - 6.9 An RTOS Customizable 111
 - 6.10 Interrupt 111
 - 6.10.1 Classification 112
 - 6.10.2 Management of Interrupt 114
 - 6.11 Linux 114
 - 6.11.1 Problems 115
 - 6.11.2 Real Time Linux 116
 - References 117

- 7 Design PCB for Embedded System** 119
 - 7.1 Materials for Printed Circuits 119
 - 7.2 Electrical Insulation on PCB 123
 - 7.3 Routing PCB 125
 - 7.4 PCB Embedded 126
 - 7.4.1 Design Guidelines 128
 - References 129

- 8 Features of High Speed Data Acquisition and Control System . . .** 131
 - 8.1 Data Acquisition System 131
 - 8.1.1 Data Acquisition Hardware 133
 - 8.1.2 Data Acquisition Software 135
 - 8.2 High Speed PCB Layout 137
 - 8.2.1 Power Supply Bypassing 141
 - 8.2.2 Stray Capacitance 142
 - 8.3 Feedback Control System 142
 - References 145

- 9 Embedded Board for High-Speed Data Acquisition and Control System** 147
 - 9.1 General Layout 147
 - 9.2 Hardware 147
 - 9.3 Software and GUI 150
 - 9.4 Real Time Software 150
 - 9.5 Future and Improvement 152
 - References 152

- Index** 153



<http://www.springer.com/978-3-319-06864-0>

Embedded Systems Design for High-Speed Data
Acquisition and Control

Di Paolo Emilio, M.

2015, XXII, 155 p. 123 illus., 5 illus. in color., Hardcover

ISBN: 978-3-319-06864-0