

Index

- A/D, *see* analog to digital converter
- AC, definition of, 19, 27
- ammeter, 13
- Ampère's Law, 30, 241
- amperes, 1
- amplifier
 - black box model for, 113
 - common-base, 123
 - common-collector, 122
 - common-drain, 147
 - common-emitter, 119
 - common-gate, 149
 - common-source, 145
 - current gain, 113
 - distortion, 127
 - emitter-follower, 122
 - feedback, 128
 - frequency response, 127
 - input impedance, 113
 - open-loop voltage gain, 113
 - output impedance, 113
 - source-follower, 147
 - voltage gain, 113
- amplitude
 - decibels, 20
 - peak, 20
 - peak-to-peak, 20
 - rms, 20
- amplitude modulation, 193
- analog to digital converter, 228
- anode, 78

- band-pass filter, 53
- band theory of solids, 69
- Barkhausen criterion, 188
- battery
 - ideal, 3
 - real, 23

- BCD, *see* binary coded decimal
- binary coded decimal, 223
- binary counters, 220
- binary numbers, 200
- bipolar junction transistor, 104
 - α , 106
 - β , 106
 - AC equivalents for, 116
 - amplifier circuits, 110
 - band structure, 105
 - biased for linear active operation, 105
 - I - V characteristics, 107
 - inverter, 110
 - npn, 104
 - pnp, 104
 - switching circuit, 108
- bit, data, 202
- BJT, *see* bipolar junction transistor
- Boolean algebra, 208
- breakpoint frequency, 40

- χ , reactance, 48
- capacitors, 27
 - equivalent circuit laws for, 28
 - in parallel, 29
 - in series, 28
 - voltage rating, 27
- carbon, resistivity of, 5
- cathode, 78
- center-tapped transformer, 87
- channel length modulation, 145
- charge carriers
 - majority, 73
 - minority, 73
- clamp circuit, 84
- clipper circuit, 84
- CMOS, 212
- complex numbers, 43
 - applied to LR circuit, 49

- complex numbers (*cont.*)
 - applied to LRC circuit, 52
 - applied to RC circuit, 45, 48
 - complex conjugate of, 45
 - magnitude of, 44
 - phase of, 44
- complex Ohm's Law, 48
- conduction band, 71
- copper, resistivity of, 5
- Cramer's Method, 16, 238
- current, definition of, 1
- current divider, 12
- current limiting, 11
- current source, definition of, 11

- D/A, *see* digital to analog converter
- DC, definition of, 19
- decoder, 224
- DeMorgan's theorems, 209
- demultiplexer, 231
- determinants, 16, 238
- dielectric constant ϵ , 27
- digital to analog converter, 227
- diode
 - I - V characteristic of, 78
 - center-tapped full-wave rectifier, 88
 - clamp circuit, 84
 - clipper circuit, 84
 - full-wave bridge rectifier, 90
 - half-wave rectifier, 87
 - light emitting, 79
 - limiter circuit, 84
 - logic circuit, 86
 - rectifier, 86-90
 - simplified model for, 81
 - switch protector, 85
 - voltage dropper circuit, 83
 - zener, 92
- doping a semiconductor, 72
- duty cycle, 22

- energy bands
 - definition of, 68
 - for a conductor, 69
 - for an insulator, 70
 - for a semiconductor, 71
- energy levels
 - atomic, 68
 - for a solid, 68
- EPROM, 233

- farad, 27
- Faraday's Law, 30, 241
- feedback, 128
- FET, *see* field-effect transistor
- field-effect transistor, 133
 - AC equivalents for, 144
 - as a switch, 140
 - I - V characteristics for, 136
 - junction, 134
 - metal oxide semiconductor, 136
 - depletion, 136
 - enhancement, 136
 - model equations for, 136
 - pinchoff, 136
 - transfer curve for, 140
- filters
 - band-pass, 53
 - high-pass, 40, 51
 - low-pass, 41, 50
 - power supply, 90
 - LC or L-section, 92
 - RC π -section, 92
 - simple capacitor, 90
- 555 timer, 180
 - astable oscillator, 181
 - cascading, 185
 - monostable operation, 183
- flip-flop
 - basic, 216
 - binary, 216
 - clocked, 217
 - gated, 217
 - J-K, 219
 - master-slave, 218
 - M-S, 218
 - R-S, 216
- forbidden band, 70
- Fourier analysis, 58
 - sawtooth wave, 60
 - square wave, 61
 - triangle wave, 61
- frequency, 20

- frequency domain analysis, 37
- frequency modulation, 197
- full adder, 214
- full-wave bridge rectifier, 90
- ground, definition of, 83
- h*-parameter model, 118
- half-adder, 214
- half-power frequency, 40
- half-wave rectifier, 87
- henry, 30
- hertz, 20
- high-pass filter
 - LR, 51
 - RC, 40
- holes in semiconductors, 72
- impedance, 47
 - of capacitor, 47
 - of inductor, 47
 - of resistor, 47
 - reactive, 48
 - resistive, 48
- impedance matching, 63
- induced voltage, 30
- inductance, 30
 - mutual, 242
 - self, 241
- inductively coupled circuits, 241
- inductors
 - in parallel, 30
 - in series, 30
- information registers, 216
- input resistance, 17
- internal resistance of battery, 23
- Karnaugh map, 206
- KCL, *see* Kirchoff's Current Law
- Kirchoff's Current Law, 2
- Kirchoff's Voltage Law, 2
- KVL, *see* Kirchoff's Voltage Law
- LED, *see* light emitting diode
- light emitting diode, 11, 79
- limiter circuit, 84
- load line method
 - applied to BJT switch, 109
 - applied to FET switch, 140
- for diode circuit, 81
- for zener diode circuit, 93
- logic gates, 204–212
 - AND, 204
 - buffer, 205
 - inverter, 206
 - making, 211
 - NAND, 205
 - NOR, 205
 - OR, 204
 - XNOR, 206
 - XOR, 205
- low-pass filter
 - LR, 50
 - RC, 41
- LRC circuit, 52
 - critically damped response, 58
 - frequency response, 53
 - overdamped response, 57
 - underdamped response, 55
- majority charge carriers, 73
- matrix, 238
- memory chips, 232
- mesh loop method, 15
- mhos, 144
- minority charge carriers, 73
- modulo-*n*, 223
- multiplexer, 229
- nichrome, resistivity of, 5
- noise, 22
- noise immunity, 200
- Norton's theorem, 10
- n-type semiconductor, 72
- Ohm's Law, 4
- ohms, 4
- op-amp, *see* operational amplifier
- open circuit, definition of, 10
- operating point, 81, 112, 116, 141, 144
- operational amplifier, 152
 - adder, 156
 - astable multivibrator, 165
 - buffer, 156
 - comparator, 153

- operational amplifier (*cont.*)
 - differential amplifier, 157
 - differentiator, 158
 - golden rules, 154
 - integrator, 158
 - inverting amplifier, 155
 - inverting input, 152
 - non-inverting amplifier, 156
 - non-inverting input, 152
 - open-loop gain, 153, 164
 - practical considerations, 159
 - bias currents, 159
 - frequency response, 164
 - input offset voltage, 162
 - slew rate limiting, 162
 - saturation voltage, 153
 - voltage follower, 156
- oscillator
 - relaxation, 171
 - 555 astable, 181
 - SCR sawtooth, 171
 - transistor astable, 174
 - sinusoidal, 185
 - crystal, 192
 - Hartley, 191
 - LC tank circuit, 190
 - RC, 186
 - stability, 188
 - Wein bridge, 189
- parallel data transmission, 202
- period T , 20
- permeability μ , 30
- phase, 20
- p-n junction
 - biased, 76
 - breakdown, 78
 - depletion region, 74
 - energy levels, 74
 - forward bias, 77
 - photon absorption, 80
 - photon emission, 80
 - reverse bias, 76
- potential difference, 1
- potentiometer, 5
- power, general definition of, 3
- power transfer optimization, 63
- prefixes, 3
- PROM, 233
- p-type semiconductor, 73
- pulse train, 22
- pulse width, 22
- Q point, 112
- quiescent point, 112
- RAM, 233
- ramp, 22
- RC circuit, 30–43
 - charging, 32
 - differentiator, 42
 - discharging, 32
 - high-pass filter, 40
 - integrator, 43
 - low-pass filter, 41
 - negative phase shifter, 41
 - positive phase shifter, 40
 - response to sine wave, 37
 - response to square wave, 33
- RC time constant, 32
- reactance χ , 48
- rectifier
 - diode full-wave, 87, 90
 - diode half-wave, 86
 - silicon controlled, 97
- regulation, 91
- regulator
 - fixed voltage, 96
 - variable voltage, 97
- repetition time, 20
- resistivity ρ , 5
- resistor
 - color bands, 5
 - current limiting, 11
 - equivalent circuit laws for, 6
 - I – V characteristic of, 4
 - in parallel, 7
 - in series, 7
 - power laws for, 5
 - power rating, 5
 - shunt, 13
- resonant frequency, 53
- rheostat, 5
- ringing, 56

- ripple factor, 91
- roll off, 127
- ROM, 233
- SCR, *see* silicon controlled rectifier
- self-inductance, 30, 241
- serial data transmission, 202
- seven-segment display, 223
- shift register, 224
 - digital waveform synthesis, 225
 - scrolling display, 224
- short circuit, definition, 10
- shunt, 13
- siemens, 144
- silicon controlled rectifier, 97
 - as a motor control, 99
 - as a switch, 98
 - I - V characteristics for, 97
- silver, resistivity of, 5
- sinusoidal signal, 20
- square wave, 21
- standard method, 14
- thermal energy, 70
- thermal transitions, 70
- Thevenin's theorem, 10
- TI-83, 240
- time constant, 32
- time domain analysis, 37
- transcendental equation, 80
- transconductance, 144
- transformer, 61, 243
 - center tapped, 87
 - impedance matching, 63
 - primary windings, 62
 - secondary windings, 62
 - turns ratio, 62
- triangle wave, 22
- TTL, 212
- universal DC bias circuit, 111, 142
- valance band, 71
- voltage, definition of, 1
- voltage divider, 12
- voltage dropper circuit, 83
- voltage source, definition of, 11
- voltmeter, 13
- volts, 1
- watts, 3
- word, data, 232
- zener diode, 92
 - as regulator, 93
 - limiter circuit, 95
 - voltage indicator circuit, 95