

Index

- AC, 23, 108, 130, 155, 174, 208
- AC analysis, 153
- AC characteristic, 209
- Accumulation, 28, 37, 38, 44, 45, 58, 169
- Accumulation mode, 1, 2, 5, 9, 15, 18, 19, 22, 23, 26, 28, 36, 38, 41, 45, 46, 57, 58, 86, 108, 109, 111–113, 116, 141, 142, 144, 145, 156, 160, 161, 165, 169, 184, 208
- Accumulation regime, 58
- Acid marker, 183
- ADG, 139
- ADS, 210
- AM, 1
- Amplifiers, 1
- Analytical model, 8, 46
- Asymmetric, 139, 142, 144
- Asymmetric device, 20, 144
- Asymmetric mode, 139
- Asymmetric model, 153
- Asymmetric operation, 139, 146
- Biological solution, 194
- Biosensor, 14, 183, 194
- Bipolar junction transistors, 1
- BJT, 1
- Body center potential, 94
- Boltzmann statistics, 12, 17, 20, 22, 46, 76, 139
- Bottom of the valence band, 30
- Boundary condition, 20, 25
- BOX, 17
- Breakdown, 2
- Buried oxide, 17
- Cancer marker, 184
- Capacitance, 81
- Carrier mobility, 88, 164
- Center potential, 27, 34, 36, 62, 79, 94, 95
- Channel conductivity, 12
- Channel doping, 23
- Channel interface, 63
- Channel length, 38
- Channel potential, 64
- Channel thermal noise, 155
- Channel thickness, 23, 60, 76
- Characteristic, 15, 25, 28, 47, 72, 185, 192
- Charge-based model, 23, 29, 57, 76, 145, 194, 208
- Charge-based relationship, 155, 160
- Charge-threshold voltage, 165
- Charge-voltage dependence, 47, 79, 185, 192
- Circuit simulation, 23
- CMOS circuits, 4
- CMOS- compatible, 4
- Common core, 50
- Compact model, 14, 23, 24
- Conduction band, 30, 186
- Conductivity modulation, 2
- Confined energy, 24
- Controlled resistance, 1
- Conventional bulk, 2
- Coulomb scattering, 10, 91
- Counter-ions, 184
- Critical center potential, 69
- Critical gate potential, 81
- Critical surface potential, 67, 69
- Cross-correlation noise, 161
- Cross-sections of electrons and holes, 186
- Current continuity, 43
- CV-measurements, 164
- Cylindrical coordinates, 26
- Cylindrical geometry, 192
- Cylindrical junctionless, 50
- Cylindrical shape, 52
- DC, 155, 174, 208
- DC characteristic, 209
- Deep depletion, 19, 20, 24, 26, 28, 54
- Deep-depletion regime, 208
- Degeneracy factor, 186
- Delay, 23
- Density of states, 29
- Depletion mode, 37, 57, 78
- Depletion region, 185
- Depletion width, 16
- Design-space, 60, 69, 197
- DIBL, 3, 27
- Dielectric thickness, 52
- Differential equation, 62
- Diffusion constant, 42
- Diffusion current, 42

- Distribution of interface states density, 193
- DNA, 183
- Donor density, 61
- Donor trap, 186
- Doping concentration, 4, 60, 69
- Doping density, 10, 72, 84, 189
- Double-gate FETs, 3, 6, 50, 60
- Drain contact, 2
- Drain current, 19, 20, 22, 23, 25, 27
- Drain-induced barrier lowering, 3, 24, 65, 92, 104
- Drift current, 41
- Drift-diffusion model, 28, 150, 164
- EDL, 184
- Effective gate voltage, 192
- Einstein relation, 42
- Electric field, 33, 62
- Electrical double layer, 184
- Electrolyte, 183
- Electron affinity, 35
- Electron current density, 42
- Electron density, 24, 199
- Electron effective mass, 30
- Electrostatics, 60
- Emission coefficients, 186
- Energy level of traps, 186
- Energy levels for interface trapped charge, 192
- Energy traps distribution, 193
- Enhancement-mode, 201
- EPFL junctionless model, 23
- EPFL-JL model, 23, 208
- Extremum potential, 146
- Fermi energy, 31
- Fermi potential, 16, 33, 43, 61, 77, 141
- Fermi potential gradient, 43
- Fermi-Dirac distribution, 29, 30
- Fick's law, 42
- Field-effect transistors, 1, 14
- FinFET, 8
- Fixed charge density, 20, 34
- Flat-band, 5, 10, 18, 19, 45, 62, 199
- Flat-band condition, 36, 38, 86, 191
- Flat-band potential, 45, 46, 68, 86, 149
- Frequency, 25
- Full depletion, 5, 200
- Full depletion approximation, 24, 86, 185, 189
- Fully depleted SOI, 4
- GAA, 14
- Gate capacitance, 2, 52, 192
- Gate leakage current, 3
- Gate length, 2
- Gate oxide capacitance, 38
- Gate-all-around, 3, 14, 55, 183
- Gaussian distribution, 21
- Germanium, 1
- Gradual-channel approximation, 17
- Harmonic oscillator, 23
- Heavily doped, 4
- High-k dielectrics, 3
- Highly doped, 46
- Hole effective mass, 30
- Hole layer, 83
- Homojunction, 9
- Hot carriers, 3
- Hspice simulation, 209
- Hybrid, 19, 45, 142
- IGFET, 2
- IM, 18
- Impurity concentration dependence, 11
- Induced gate noise, 155, 159
- Initial guess, 25
- Insulated-gate semiconductor field-effect transistor, 2
- Interface-charge density, 193
- Intrinsic carrier density, 77
- Intrinsic delay, 86, 88, 89
- Inversion layer, 4, 15, 41, 60, 64, 76, 81, 200
- Inversion mode, 3, 5, 8–10, 13–15, 20, 23, 25, 78, 92, 164, 171
- Inversion-mode, 184, 185
- Ion-sensitive field-effect transistor, 183
- Ionized dopants, 10
- ISFET, 183
- JL VeSFET, 197
- Junction, 1
- Junction capacitance, 3
- Junction field-effect transistor, 15, 174
- Junction unipolar gate FET, 174
- Junction-based, 5
- Junctionless, 3
- Junctionless field-effect transistor, 4
- Leakage current, 2
- Lifetime, 202
- Linear regime, 208
- Linearization, 17
- Liquid-solid interface, 184
- Long-channel, 12, 25
- Low-field mobility, 164
- Low-power, 92
- MacLaurin series, 62
- Majority carrier, 5, 15, 29, 41
- Maxwell-Boltzmann statistics, 30
- Metal-semiconductor work function difference, 35
- Miniaturization limits, 1
- Minimum feature size, 2
- Minority carrier, 29, 61, 76
- Minority carrier generation, 200, 202
- Mobile charge density, 20–22, 26, 34, 41, 69, 153
- Mobility, 10, 14
- Moore's Law, 2
- MOSFET, 2
- Multigate, 3
- Multiscale quantum mechanics, 28

- Nanowire, 3, 8, 12, 14, 24, 28, 29, 50, 54, 82, 183, 184
- Negative and positive ions, 184
- Noise, 155, 208
- Nondegenerate semiconductor, 43, 50
- Nonequilibrium Green function, 12, 24, 28
- Numerical simulation, 46
- Occupation probability, 192
- Off-current, 60, 71, 200
- Off-gate voltage, 73
- Ohm's law, 16
- On-current, 10, 60
- Pao-Sah integral, 26
- Parabolic approximation, 16, 20, 21, 25, 27, 94
- Parabolic potential, 92, 146
- Partially depleted SOI, 201
- Partly accumulated, 46
- Partly depleted, 46
- Performance, 86
- Perturbation potential, 24
- Pinch-off voltage, 176
- pn junction, 4
- Poisson equation, 12, 76
- Poisson-Boltzmann equation, 17, 20, 26, 50, 55
- Poly-crystalline silicon, 2
- Potential distribution, 27, 93, 94, 199
- Potential fluctuation, 11
- Power consumption, 3, 23, 86
- Power spectral density, 155
- Protein marker, 183
- QCE, 23
- Quantum confinement effects, 23
- Quantum correction, 24
- Quantum dot, 3
- Quantum energy balance, 28
- Quantum mechanical correction, 12
- Quantum mechanical effects, 23
- Quantum transport simulation, 14
- Quantum well, 24
- Quasi-Fermi potential, 61, 63, 151, 158
- Rail-to-rail supply voltage, 73, 197
- Random dopant fluctuation, 3, 11, 12, 92
- Receptor molecule, 183
- Reliability, 1, 3
- Saturation, 54, 208
- Scattering, 42
- Schrödinger equation, 23, 30
- Self-depletion, 186
- Semiconductor band-gap, 35
- Semiconductor thickness, 62
- Semiconductor-insulator interface, 29, 93
- Short-channel devices, 4, 92
- Short-channel effects, 8, 9, 92, 101
- Silicon thickness, 41, 72, 84
- SOI, 3, 201
- Solid-state, 1
- Source contact, 2
- Speed, 86
- Split-CV, 164
- Strong inversion regime, 172
- Subband energy, 23
- Substrate, 4
- Subthreshold behavior, 11, 92
- Subthreshold operation, 200
- Subthreshold regime, 16
- Subthreshold swing, 3, 17, 24, 25, 27, 92
- subthreshold swing degradation, 193
- Surface electric field, 21, 51
- Surface potential, 12, 17, 18, 20, 34, 62, 65, 79, 95, 188
- Surface traps, 185
- Surface-roughness scattering, 174
- Surface-to-volume ratio, 183
- Symmetric, 108
- Symmetric double-gate, 29
- Symmetric gate capacitance, 35
- Symmetric operation, 25, 139
- TCAD simulation, 38, 47, 53, 149, 194
- Technology node, 2
- Thermal budget, 4
- Thermal velocity, 186
- Threshold voltage, 5, 11, 16, 18, 19, 22–25
- Threshold voltage roll-off, 3
- Threshold voltage variation, 11
- Top of the conduction band, 29
- Transcapacitance, 25, 27, 108
- Transconductance, 47
- Transient current, 200
- Transistor, 1
- Transition layer, 183
- Traps' occupation probability, 186
- Tri-gate, 3
- Tunnel FETs, 3
- Twin gate VeSFET, 197
- Undoped silicon, 31
- Ungated devices, 192
- Vacuum tube, 1
- Valence band, 30, 186
- Vertical slit FET, 3
- Vertical transistors, 3
- VeSFET, 3, 6, 8
- VeSTIC, 8
- Virtual device, 144
- Voltage-controlled resistor, 4
- Ward-Dutton charge partitioning, 28
- Weak accumulation, 58
- Weak depletion, 26
- Weak inversion, 63
- Y-function, 164