Index

$\Sigma-\Delta$ converters  
principle, 33
(W/L) ratio, 92
µTAS, 122
4-wire technique, 26

ABS, 336
absorption coefficient, 82
accelerometers, 177
accuracy, 189
acoustoelectric effect, 67
active guarding, 233
active sensor, 4
actuators, 62
advanced chopping, 35
ambiguous sensor, 11
angular encoder, 228
course measurement, 228, 229
precise measurement, 228
anti-windup controller, 219
ARM7, 359
asynchronous converters, 283
auto-calibration, 243, 282
avalanche multiplication factor, 110

backside illumination, 101
bonding
anodic, 133
glass-to-glass, 133
glass-to-silicon, 133
silicon-to-silicon, 133
braking system, 335
bridge interface, 45
bridge interface circuit, 304
build-in voltage, 95
burglary alarm, 171

C high-level programming language, 353
calibration and trimming, 208
calorimeter, 178, 214
cantilever beam, 161
capacitive sensor, 225
circuit configuration, 242
interface, 240, 241
principles, 226
shunting conductances, 240
capture, 351
CCD, 69
central processing unit, 345
channel-charge injection, 35, 286
charge coupled device, 69
chemical sensors, 121
chopping, 34, 243, 283
advanced, 34
Clark cell, 74
Clausius–Mossotti factor, 141
clock and timer system, 346
clock-feedthrough, 35, 286
clock module, 349
clogging, 138
closed loop sensor system, 5
color
sensor, 113
condensation, 234
<table>
<thead>
<tr>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>conduction band, 95</td>
</tr>
<tr>
<td>conductivity gauge, 176</td>
</tr>
<tr>
<td>contamination, 234</td>
</tr>
<tr>
<td>continuity equation, 88</td>
</tr>
<tr>
<td>conversion time, 318</td>
</tr>
<tr>
<td>converters</td>
</tr>
<tr>
<td>analog-to-digital, 283</td>
</tr>
<tr>
<td>asynchronous, 283</td>
</tr>
<tr>
<td>charge-to-time, 286, 300</td>
</tr>
<tr>
<td>continuous-time, 284</td>
</tr>
<tr>
<td>duty-cycle-to-digital, 325</td>
</tr>
<tr>
<td>frequency-to-digital, 315, 331</td>
</tr>
<tr>
<td>phase-shift-to-digital, 326</td>
</tr>
<tr>
<td>switched-capacitor (SC), 284</td>
</tr>
<tr>
<td>time-to-digital, 333</td>
</tr>
<tr>
<td>corroding-free potential, 30</td>
</tr>
<tr>
<td>Coulter counter, 138</td>
</tr>
<tr>
<td>CPU, 345</td>
</tr>
<tr>
<td>cross-effects, 27</td>
</tr>
<tr>
<td>cross-quad capacitor, 229</td>
</tr>
<tr>
<td>cross sensitivity, 190</td>
</tr>
<tr>
<td>cytometers, 135</td>
</tr>
<tr>
<td>DACs, 347</td>
</tr>
<tr>
<td>DAQ, 314</td>
</tr>
<tr>
<td>data acquisition, 314</td>
</tr>
<tr>
<td>dead zones, 295</td>
</tr>
<tr>
<td>de-chopping, 34</td>
</tr>
<tr>
<td>Defining Fixed Points, 189</td>
</tr>
<tr>
<td>DEM, 38</td>
</tr>
<tr>
<td>PTAT voltage source, 206</td>
</tr>
<tr>
<td>DEM switched capacitor amplifier, 39</td>
</tr>
<tr>
<td>DEP, 141</td>
</tr>
<tr>
<td>sorter, 141</td>
</tr>
<tr>
<td>depletion layer, 94</td>
</tr>
<tr>
<td>detection limit, 103</td>
</tr>
<tr>
<td>detectivity D*, 104</td>
</tr>
<tr>
<td>detector</td>
</tr>
<tr>
<td>absorbing, 79</td>
</tr>
<tr>
<td>intrinsic, 81</td>
</tr>
<tr>
<td>photon, 79, 80</td>
</tr>
<tr>
<td>quantum, 79</td>
</tr>
<tr>
<td>thermal, 79</td>
</tr>
<tr>
<td>dielectrophoresis</td>
</tr>
<tr>
<td>effect, 140</td>
</tr>
<tr>
<td>forces, 141</td>
</tr>
<tr>
<td>hydrodynamic forces, 140</td>
</tr>
<tr>
<td>seperator, 141</td>
</tr>
<tr>
<td>diffusion coefficient, 88</td>
</tr>
<tr>
<td>diffusion length</td>
</tr>
<tr>
<td>electron, 98</td>
</tr>
<tr>
<td>digital signal processors, 343</td>
</tr>
<tr>
<td>DIN-IEC 751 standard, 196</td>
</tr>
<tr>
<td>display device, 57</td>
</tr>
<tr>
<td>drift velocity, 92</td>
</tr>
<tr>
<td>DSPs, 343</td>
</tr>
<tr>
<td>duty-cycle-modulated signal, 209, 324</td>
</tr>
<tr>
<td>duty-cycle modulators, 288</td>
</tr>
<tr>
<td>dynamic amplification, 37</td>
</tr>
<tr>
<td>dynamic behavior, 194</td>
</tr>
<tr>
<td>dynamic divider, 40</td>
</tr>
<tr>
<td>dynamic element matching, 38, 206, 283</td>
</tr>
<tr>
<td>dynamic-feedback, 38</td>
</tr>
<tr>
<td>dynamic voltage processing, 306</td>
</tr>
<tr>
<td>ear thermometers, 187</td>
</tr>
<tr>
<td>electrical equivalents of thermal parameters, 157</td>
</tr>
<tr>
<td>electric-field-bending, 231, 232</td>
</tr>
<tr>
<td>electrode configuration</td>
</tr>
<tr>
<td>condensation, 231, 234</td>
</tr>
<tr>
<td>contamination, 231, 234</td>
</tr>
<tr>
<td>electric-field-bending, 231</td>
</tr>
<tr>
<td>segmented electrodes structures, 234</td>
</tr>
<tr>
<td>three-layered electrode structure, 235</td>
</tr>
<tr>
<td>electrolytic conduction, 67</td>
</tr>
<tr>
<td>electronic nose, 130</td>
</tr>
<tr>
<td>electrostatic-field problems, 236</td>
</tr>
<tr>
<td>EM field sensor, 173</td>
</tr>
<tr>
<td>emissivity, 154</td>
</tr>
<tr>
<td>enthalpy, 170</td>
</tr>
<tr>
<td>enzymatic activity, 144</td>
</tr>
<tr>
<td>enzymatic oxidation, 170</td>
</tr>
<tr>
<td>EPROM, 346</td>
</tr>
<tr>
<td>errors</td>
</tr>
<tr>
<td>multi-path, 34</td>
</tr>
<tr>
<td>random, 33</td>
</tr>
<tr>
<td>systematic, 33</td>
</tr>
<tr>
<td>ESD protection, 299</td>
</tr>
<tr>
<td>event managers, 368</td>
</tr>
<tr>
<td>EVs, 368</td>
</tr>
<tr>
<td>Index</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>excitation signals, 29</td>
</tr>
<tr>
<td>DC signals, 30</td>
</tr>
<tr>
<td>pulsed signals, 30</td>
</tr>
<tr>
<td>sinusoidal, 27</td>
</tr>
<tr>
<td>square-wave, 30</td>
</tr>
<tr>
<td>wave shape, 282</td>
</tr>
<tr>
<td>waveform, 30</td>
</tr>
<tr>
<td>extinction coefficient, 82</td>
</tr>
<tr>
<td>Fabry–Perot interferometer, 115</td>
</tr>
<tr>
<td>field-bending effect, 237</td>
</tr>
<tr>
<td>fine leakage, 26</td>
</tr>
<tr>
<td>floating electrode, 233</td>
</tr>
<tr>
<td>floating membrane, 160</td>
</tr>
<tr>
<td>flow sensors, 174</td>
</tr>
<tr>
<td>FPA, 172</td>
</tr>
<tr>
<td>frequency-to-digital conversion, 316</td>
</tr>
<tr>
<td>front-end circuits, 41</td>
</tr>
<tr>
<td>capacitive sensors, 43</td>
</tr>
<tr>
<td>dedicated, 280, 281</td>
</tr>
<tr>
<td>resistive bridges, 45</td>
</tr>
<tr>
<td>thermistors, 45</td>
</tr>
<tr>
<td>gain-phase analyzer, 27</td>
</tr>
<tr>
<td>galvanic effect, 67</td>
</tr>
<tr>
<td>geometrical correction factor, 253</td>
</tr>
<tr>
<td>glass-to-glass anodic bonding, 133</td>
</tr>
<tr>
<td>glucose</td>
</tr>
<tr>
<td>enzymatic oxidation, 170</td>
</tr>
<tr>
<td>glucose oxidase, 170</td>
</tr>
<tr>
<td>gross leakage, 26</td>
</tr>
<tr>
<td>haemoglobin</td>
</tr>
<tr>
<td>spectra, 127</td>
</tr>
<tr>
<td>Hall</td>
</tr>
<tr>
<td>coefficient, 252, 255, 260, 276</td>
</tr>
<tr>
<td>devices, 253</td>
</tr>
<tr>
<td>effect, 249, 250, 253</td>
</tr>
<tr>
<td>field, 251</td>
</tr>
<tr>
<td>mobility, 260</td>
</tr>
<tr>
<td>voltage, 251</td>
</tr>
<tr>
<td>Hall device</td>
</tr>
<tr>
<td>biasing, 260</td>
</tr>
<tr>
<td>horizontal, 256, 258</td>
</tr>
<tr>
<td>magnetic sensitivity, 260</td>
</tr>
<tr>
<td>noise, 255</td>
</tr>
<tr>
<td>nonlinearity, 256</td>
</tr>
<tr>
<td>offset, 255</td>
</tr>
<tr>
<td>offset reduction, 260</td>
</tr>
<tr>
<td>spinning-current technique, 260</td>
</tr>
<tr>
<td>thermal cross sensitivity, 256</td>
</tr>
<tr>
<td>vertical, 258</td>
</tr>
<tr>
<td>Hall effect, 67</td>
</tr>
<tr>
<td>Hall probe</td>
</tr>
<tr>
<td>3-axis, 270</td>
</tr>
<tr>
<td>magnetic microscopy, 271</td>
</tr>
<tr>
<td>Hall sensor, 72</td>
</tr>
<tr>
<td>Harvard architecture, 345</td>
</tr>
<tr>
<td>heat leakage, 194</td>
</tr>
<tr>
<td>heat transfer mechanisms, 155</td>
</tr>
<tr>
<td>heating</td>
</tr>
<tr>
<td>homogeneous, 164</td>
</tr>
<tr>
<td>resistive, 164</td>
</tr>
<tr>
<td>high-speed screening, 12</td>
</tr>
<tr>
<td>HTS, 144</td>
</tr>
<tr>
<td>humidity sensor, 229</td>
</tr>
<tr>
<td>capacitive, 227</td>
</tr>
<tr>
<td>leakage current, 27</td>
</tr>
<tr>
<td>hybrid packages, 66</td>
</tr>
<tr>
<td>impedance, 28</td>
</tr>
<tr>
<td>in situ applications, 126</td>
</tr>
<tr>
<td>incremental sigma–delta A/D converter, 294</td>
</tr>
<tr>
<td>index of refraction, 81</td>
</tr>
<tr>
<td>indirect A/D converter, 294</td>
</tr>
<tr>
<td>industrial revolution, 1</td>
</tr>
<tr>
<td>informatization, 1</td>
</tr>
<tr>
<td>infrared radiation, 154</td>
</tr>
<tr>
<td>infrared sensor, 171, 187</td>
</tr>
<tr>
<td>integrated smart sensor</td>
</tr>
<tr>
<td>definition, 9</td>
</tr>
<tr>
<td>intelligent transducer</td>
</tr>
<tr>
<td>definition, 61</td>
</tr>
<tr>
<td>interface</td>
</tr>
<tr>
<td>resistive sensors, 45</td>
</tr>
<tr>
<td>interrupts, 350</td>
</tr>
<tr>
<td>intrinsic carrier concentration, 88</td>
</tr>
<tr>
<td>ionization coefficient, 110</td>
</tr>
<tr>
<td>IR absorber, 187</td>
</tr>
<tr>
<td>ITO, 90</td>
</tr>
</tbody>
</table>
JTAG, 374

laser-induced fluorescence, 145
leakage current, 105
learning from nature, 51
LEDs, 347
light-emitting diodes, 347
LIF, 145
lifetime
electron, 98
hole, 99
liquid-level gauge
capacitive, 230
long-term stability, 189
Lorentz force, 250, 251

MAC module, 345
magnetic concentrator, 265, 266, 267
magnetic microscopy, 271
magnetic sensor system
angular position sensor, 267
self calibration, 265

MCUs, 343
MDC, 316
mechanization, 1
membrane structure
cantilever beam, 161
closed, 163
floating, 160
memory
EPROM, 346
flash, 346
ROM, 346
MEMS, 101, 165
metal oxides, 65
method of the dependent count, 316
micro total analysis systems, 122
microcalorimeter, 169
microcontroller, 343
microfluidics devices, 131
micro-Hall sensor, 274
micro-organisms, 213
detection, 29
mismatching of components, 296
mobility, 88
modifier, 56

modulating sensor, 4
modulation
period, 32
pulse-width, 32
modulator
capacitive modes, 43
module
output-compare, 354
multi-path errors, 33
multi-path signals, 30
multiple-electrode capacitive sensors, 237
multiplexed sensing elements, 295
multiply-and-accumulate, 345

NADH, 144
nanocalorimeter, 177
NEP, 106
Nernst effect, 67
nested-chopper technique, 35
noise and resolution, 190

Object-Oriented Design, 24
oil-condition monitoring
viscosity-permittivity, 129
oil deterioration
infrared measurement, 130
one-time-programming capability, 346
open loop sensor system, 5
optical
sensor, 79
optical glass fibers, 66
optical microspectrometer, 115
OTP, 346
output-compare, 354
oximeter, 127
oxyhaemoglobin
spectra, 127

packaging
compatibility, 25
parasitic capacitance effect, 239
particle-shape sensor, 135
passive sensor, 4
period-modulated signal, 31
period modulation, 290
<table>
<thead>
<tr>
<th>Index</th>
<th>383</th>
</tr>
</thead>
<tbody>
<tr>
<td>peripherals, 350</td>
<td></td>
</tr>
<tr>
<td>analog, 347</td>
<td></td>
</tr>
<tr>
<td>digital, 346</td>
<td></td>
</tr>
<tr>
<td>personal detector, 233</td>
<td></td>
</tr>
<tr>
<td>PGA, 372</td>
<td></td>
</tr>
<tr>
<td>phase transition, 154</td>
<td></td>
</tr>
<tr>
<td>phonon, 83</td>
<td></td>
</tr>
<tr>
<td>photoconductive gain, 92</td>
<td></td>
</tr>
<tr>
<td>photoconductor, 88, 89</td>
<td></td>
</tr>
<tr>
<td>photodiode, 88</td>
<td></td>
</tr>
<tr>
<td>avalanche, 109</td>
<td></td>
</tr>
<tr>
<td>PIN, 100</td>
<td></td>
</tr>
<tr>
<td>stacked, 102</td>
<td></td>
</tr>
<tr>
<td>photon flux, 83</td>
<td></td>
</tr>
<tr>
<td>phototransistor, 109</td>
<td></td>
</tr>
<tr>
<td>photovoltaic effect, 67</td>
<td></td>
</tr>
<tr>
<td>physical chemosensor, 74</td>
<td></td>
</tr>
<tr>
<td>physical chemosensors</td>
<td></td>
</tr>
<tr>
<td>definition, 123</td>
<td></td>
</tr>
<tr>
<td>electrical principles, 126</td>
<td></td>
</tr>
<tr>
<td>energy domains, 125</td>
<td></td>
</tr>
<tr>
<td>magnetic principles, 126</td>
<td></td>
</tr>
<tr>
<td>mechanical principles, 125</td>
<td></td>
</tr>
<tr>
<td>optical principles, 124</td>
<td></td>
</tr>
<tr>
<td>thermal principles, 125</td>
<td></td>
</tr>
<tr>
<td>piezoelectricity</td>
<td></td>
</tr>
<tr>
<td>effect, 65</td>
<td></td>
</tr>
<tr>
<td>materials, 65</td>
<td></td>
</tr>
<tr>
<td>polymers, 65</td>
<td></td>
</tr>
<tr>
<td>piezoresistivity</td>
<td></td>
</tr>
<tr>
<td>pressure sensor, 70</td>
<td></td>
</tr>
<tr>
<td>Pirani gauges, 154</td>
<td></td>
</tr>
<tr>
<td>platinum (Pt) resistance thermometer, 189</td>
<td></td>
</tr>
<tr>
<td>thin-film, 189</td>
<td></td>
</tr>
<tr>
<td>platinum (Pt) resistors, 186</td>
<td></td>
</tr>
<tr>
<td>platinum resistors, 196</td>
<td></td>
</tr>
<tr>
<td>class A, 196</td>
<td></td>
</tr>
<tr>
<td>tolerances class A, 197</td>
<td></td>
</tr>
<tr>
<td>Poisson equation, 95</td>
<td></td>
</tr>
<tr>
<td>polling, 351</td>
<td></td>
</tr>
<tr>
<td>polymers, 65</td>
<td></td>
</tr>
<tr>
<td>position sensitive detector, 69</td>
<td></td>
</tr>
<tr>
<td>Power Spectrum VI module, 315</td>
<td></td>
</tr>
<tr>
<td>power-down, 47</td>
<td></td>
</tr>
<tr>
<td>power-down modes, 348</td>
<td></td>
</tr>
<tr>
<td>Prandtl number, 154</td>
<td></td>
</tr>
<tr>
<td>protection circuit, 298</td>
<td></td>
</tr>
<tr>
<td>PSD, 69</td>
<td></td>
</tr>
<tr>
<td>pseudo noise, 291</td>
<td></td>
</tr>
<tr>
<td>psychrometer, 170</td>
<td></td>
</tr>
<tr>
<td>PTAT</td>
<td></td>
</tr>
<tr>
<td>current source, 204</td>
<td></td>
</tr>
<tr>
<td>temperature sensor, 203</td>
<td></td>
</tr>
<tr>
<td>PTAT-voltage generator</td>
<td></td>
</tr>
<tr>
<td>DEM, 206</td>
<td></td>
</tr>
<tr>
<td>pulse-width modulation, 290, 344, 353</td>
<td></td>
</tr>
<tr>
<td>PWM, 344, 353</td>
<td></td>
</tr>
<tr>
<td>QEP, 369</td>
<td></td>
</tr>
<tr>
<td>quadrature encoder pulse, 369</td>
<td></td>
</tr>
<tr>
<td>quantization error, 291, 318</td>
<td></td>
</tr>
<tr>
<td>quantization noise, 191, 291</td>
<td></td>
</tr>
<tr>
<td>quantum efficiency, 80</td>
<td></td>
</tr>
<tr>
<td>quasi-digital sensors, 313</td>
<td></td>
</tr>
<tr>
<td>radiation</td>
<td></td>
</tr>
<tr>
<td>infrared, 154</td>
<td></td>
</tr>
<tr>
<td>radiation properties, 79</td>
<td></td>
</tr>
<tr>
<td>radio frequency identification, 360</td>
<td></td>
</tr>
<tr>
<td>random errors, 33</td>
<td></td>
</tr>
<tr>
<td>random-sampling method, 324</td>
<td></td>
</tr>
<tr>
<td>real-time operation systems, 374</td>
<td></td>
</tr>
<tr>
<td>reduced instruction set, 345</td>
<td></td>
</tr>
<tr>
<td>relaxation oscillator, 245</td>
<td></td>
</tr>
<tr>
<td>resistance</td>
<td></td>
</tr>
<tr>
<td>parasitic, 27</td>
<td></td>
</tr>
<tr>
<td>resistive heating, 164</td>
<td></td>
</tr>
<tr>
<td>resistor interface, 45</td>
<td></td>
</tr>
<tr>
<td>responsivity, 79</td>
<td></td>
</tr>
<tr>
<td>Reynolds number, 154</td>
<td></td>
</tr>
<tr>
<td>RFID, 360</td>
<td></td>
</tr>
<tr>
<td>RISC, 345, 355</td>
<td></td>
</tr>
<tr>
<td>RMS converters, 172</td>
<td></td>
</tr>
<tr>
<td>ROM, 346</td>
<td></td>
</tr>
<tr>
<td>RTOS, 374</td>
<td></td>
</tr>
<tr>
<td>Salmonella</td>
<td></td>
</tr>
<tr>
<td>infection, 29</td>
<td></td>
</tr>
<tr>
<td>Typhimurium, 29</td>
<td></td>
</tr>
<tr>
<td>sampling error, 291</td>
<td></td>
</tr>
<tr>
<td>saturation-current density, 105</td>
<td></td>
</tr>
<tr>
<td>SAW, 74, 168</td>
<td></td>
</tr>
</tbody>
</table>
scattering, 252
scavenging
  energy, 75
Schmitt trigger, 210
Seebeck coefficient
  definition, 165
  some values, 167
Seebeck effect, 58, 59, 67
selective detection, 238
  selected parameters, 239
self-calibration, 265
  integrated coil, 265
self-generating sensor, 4
self-heating, 191, 192
sensitivity
  absolute, 254
  current-related, 254
  voltage-related, 255
sensorization, 1
short-term stability, 189
shot noise, 105
shunting conductance, 240
sigma–delta converter, 294
signal domains, 3, 58, 59
silicon
  bandgap, 82
silicon sensors, 55
smart car, 2, 16
smart home, 2, 16
smart sensor
  definition, 9, 24, 61, 185
smart sensor systems
  definition, 11, 23
smart temperature sensor, 208, 214
  noise, 215
  self heating, 216
  SM T, 160, 211
smart temperature-sensor systems
  with discrete elements, 212
smart toys, 19
SN R, 106
SoC, 373
solar cell, 88
spinning-current, 269
spinning-current technique, 260
star-connected sensor system, 16

Stefan–Boltzmann constant, 154
Stokes approximation, 140
Stokes approximation, 140
SU-8, 134
Surface-Acoustic-Wave (SAW) oscillator, 217
surface acoustic waves, 74
surface recombination velocity, 100
synchronous detection, 34
system clock, 349
systematic errors, 33
temperature sensors
  accuracy, 189
dynamic behaviour, 194
  heat leakage along wires, 194
  noise and resolution, 190
  requirements, 188
  self-heating, 192
  short-term and long-term stability, 189
tandem transducers, 60
TCD, 127
temperature-sensing elements
  Pt resistors, 187
  thermistors, 187
  thermocouples, 187
  transistors, 187
  thermal accelerometers, 177
  thermal capacity, 157
  thermal conductivity detector, 127
  thermal cross-sensitivity, 256
  thermal model, 161
thermal properties
  conduction, 153
  convection, 153
  phase transition, 154
  radiation, 154
thermal resistance, 156
thermal sensors
  conduction, 153
  convection, 153
  phase-transition, 153
  radiation, 153
thermal-conductance sensors, 151, 152
thermal-conductivity gauge, 176
thermal-power sensors, 151
<table>
<thead>
<tr>
<th>Index</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>thermal wind meter, 175</td>
<td></td>
</tr>
<tr>
<td>thermistors, 187, 198</td>
<td></td>
</tr>
<tr>
<td>characteristics, 198</td>
<td></td>
</tr>
<tr>
<td>interface, 45</td>
<td></td>
</tr>
<tr>
<td>linearization, 199</td>
<td></td>
</tr>
<tr>
<td>thermocouple, 165, 188, 305</td>
<td></td>
</tr>
<tr>
<td>thermocouple-voltage processor, 305</td>
<td></td>
</tr>
<tr>
<td>thermopiles, 165</td>
<td></td>
</tr>
<tr>
<td>thick-film, 66</td>
<td></td>
</tr>
<tr>
<td>thin-film, 66</td>
<td></td>
</tr>
<tr>
<td>three-signal auto-calibration, 243</td>
<td></td>
</tr>
<tr>
<td>three-signal measurement, 36</td>
<td></td>
</tr>
<tr>
<td>throughput screening, 144</td>
<td></td>
</tr>
<tr>
<td>time interval measurement, 352</td>
<td></td>
</tr>
<tr>
<td>timer modules, 351</td>
<td></td>
</tr>
<tr>
<td>transducers</td>
<td></td>
</tr>
<tr>
<td>active, 63</td>
<td></td>
</tr>
<tr>
<td>input, 56</td>
<td></td>
</tr>
<tr>
<td>modulating, 63</td>
<td></td>
</tr>
<tr>
<td>output, 56</td>
<td></td>
</tr>
<tr>
<td>passive, 63</td>
<td></td>
</tr>
<tr>
<td>self-generating, 63</td>
<td></td>
</tr>
<tr>
<td>transistor temperature sensor, 188, 200</td>
<td></td>
</tr>
<tr>
<td>characteristics, 201</td>
<td></td>
</tr>
<tr>
<td>models, 201</td>
<td></td>
</tr>
<tr>
<td>PTAT sensor, 203</td>
<td></td>
</tr>
<tr>
<td>transit time, 93</td>
<td></td>
</tr>
<tr>
<td>transmission coefficient, 85</td>
<td></td>
</tr>
<tr>
<td>trans-resistance circuit, 107</td>
<td></td>
</tr>
<tr>
<td>triple point of water, 189</td>
<td></td>
</tr>
<tr>
<td>two-port measurement, 27, 282</td>
<td></td>
</tr>
<tr>
<td>UART, 355</td>
<td></td>
</tr>
<tr>
<td>UFDC, 333</td>
<td></td>
</tr>
<tr>
<td>undesired interaction</td>
<td></td>
</tr>
<tr>
<td>chemical effects, 297</td>
<td></td>
</tr>
<tr>
<td>electrical effects, 297</td>
<td></td>
</tr>
<tr>
<td>physical effects, 297</td>
<td></td>
</tr>
<tr>
<td>Universal Frequency-to-Digital Converter, 333</td>
<td></td>
</tr>
<tr>
<td>universal sensor interfaces, 51, 279</td>
<td></td>
</tr>
<tr>
<td>universal transducer interface, 41</td>
<td></td>
</tr>
<tr>
<td>UTI, 41, 300, 356, 366</td>
<td></td>
</tr>
<tr>
<td>nonlinearity, 49</td>
<td></td>
</tr>
<tr>
<td>resolution, 48</td>
<td></td>
</tr>
<tr>
<td>UTI chip, 47</td>
<td></td>
</tr>
<tr>
<td>UTI modes, 47</td>
<td></td>
</tr>
<tr>
<td>vacuum sensor, 174</td>
<td></td>
</tr>
<tr>
<td>virtual reality, 19–20</td>
<td></td>
</tr>
<tr>
<td>virtual thermometer, 337</td>
<td></td>
</tr>
<tr>
<td>voltage reference</td>
<td></td>
</tr>
<tr>
<td>intrinsic, 207</td>
<td></td>
</tr>
<tr>
<td>von Neumann architecture, 345</td>
<td></td>
</tr>
<tr>
<td>wave vectors, 83</td>
<td></td>
</tr>
<tr>
<td>wind meter, 174</td>
<td></td>
</tr>
<tr>
<td>wire impedance, 26</td>
<td></td>
</tr>
<tr>
<td>yeast cell</td>
<td></td>
</tr>
<tr>
<td>detection, 137</td>
<td></td>
</tr>
<tr>
<td>zener-zapping, 208, 209</td>
<td></td>
</tr>
<tr>
<td>385</td>
<td></td>
</tr>
</tbody>
</table>