

Index

0-9

- 0 V potential, 157
- 19-inch rack system, 36

A

- Absolute zero, 80
- Aging, 57
- Air resistance (flow channel), 141
- Appliance classes, 40
- Availability, 65
 - achieved, 65
 - inherent, 65
 - operational, 65

B

- Back-annotation data, 24
- Baffle, 136
- Bar chart, 17
- Bare die, 38
- Base failure rate, 57
- Bathtub curve, 52
- Bill of components, 18
- Black body (radiation), 101
- Box assembly, 207
- Box assembly technique, 37
- Built-in obsolescence, 199
- Bypass effect, 168

C

- CAD model, 24
- Capacitive coupling, 152
- Cascade principle (recycling), 212
- Celsius, 80
- CE marking, 40
- Chassis, 160
- Chassis system, 37
- Chimney effect, 136
- Circuit diagram, 22

- Circuit schematic, 22
- Circular economy, 196
- Coaxial cable, 176
- Coextrusion, 212
- Communication function, 34
- Communication layer (of electronic systems), 33
- Compact design, 35
- Compatibility matrix, 213
- Component (of electronic systems), 31, 35
- Computer-aided design, 24
- Conceptual stage, 7
- Conduction heat transfer, 90
- Conduction thermal resistance, 93
- Conductive coupling, 150
- Convection, 94
 - forced, 94
 - natural, 94
- Convection heat transfer coefficient, 96
- Convection thermal resistance, 96
- Convective heat transfer, 94
- Coupling, 148
 - capacitive, 152
 - conductive, galvanic, 150
 - electromagnetic, radiative, 156
 - inductive, magnetic, 154
- Coupling coefficient, 155
- Critical path (network plan), 17
- Culprit (EMC), 148
- Custom-assembled design, 35
- Cutlery tray technique, 207

D

- Datum (technical drawing), 226
- Decoupling capacitor, 152
- Derating, 60
- Design architectures (of electronic systems), 35
- Design for adaptability, 203

Design for disassembly, 208
 Design for durability, 202
 Design for regeneration, 202
 Design for reliability, 64
 Design process, 6
 Design stages (of a design process), 7
 Desktop standing device, 38
 Development stage (product), 5
 Differential signal transmission, 165
 Dimensioning (technical drawing), 21
 Dimension line (technical drawing), 224
 Dimensions (technical drawing), 224
 Discrete component, 38
 Disturbance layer (of electronic systems), 33
 Downcycling, 212
 Drift, 57
 Drift fails, 71
 Durability (electronic system), 201
 Dynamic field, 168

E

Early failure, 52
 Earth current, 164
 Electrical energy, 79
 Electromagnetic compatibility (EMC), 148
 Electromagnetic coupling, 156
 Electromagnetic field, 156, 168, 176
 Electronic functional groups, 38
 Electronic system, 31
 Electronic systems design, 1
 Electroquasistatic field, 168
 Electrostatic discharge (ESD), 181
 Electrostatic discharge protected area (EPA), 183
 Electrostatic field, 168
 Elements (of electronic systems), 34
 EMC-compliant system cabinet, 188
 Emissivity, 102
 Enclosure temperature, 117
 Energy-storage capacitor, 152
 Entropy (of materials), 194
 Environment (of electronic systems), 32
 ESD-suppression measures, 182
 E-series (preferred numbers), 230
 EU declaration of conformity, 40
 Exponential distribution, 54
 External electrical interconnects, 39

F

Failure density function, 51
 Failure distribution function, 50, 55
 Failure in time (FIT), 59
 Failure rate, 51, 58
 Fan, 110

axial-flow fan, 110
 centrifugal fan, 110
 tangential fan, 111
 Fan acoustic noise, 112
 Fan curve, 111, 142
 Faraday cage, 174
 Feasibility study, 12
 Ferromagnetic materials, 169
 FE simulation, 27
 Finite-element model, 27
 Finite-element simulation, 27
 Floor standing device, 38
 Form tolerance (technical drawing), 227
 Functional specification, 13
 Function-based dimensioning, 225
 Function (of electronic systems), 32, 33

G

Gantt chart, 17
 Gaussian normal distribution, 53
 General tolerance (technical drawing), 226
 Grashof number, 97
 Gray body (radiation), 101
 Ground, 157
 loop, 164
 multi-point, 160
 single-point, star shaped, 159
 Ground bounce, 158

H

Hazard rate/function, 52
 Heat, 80
 Heat energy, 80
 Heat exchanger, 138
 Heat flow, 80
 Heat flux, 80
 Heat loss, 80
 Heat pipe, 112
 Heat sink, 107
 Heat source (thermal network), 86
 Heat transfer, 80

I

Identification number (technical drawing), 220
 Immunity (EMC), 148
 Implementation stage (of a design process), 7
 Induction (ESD), 181
 Inductive coupling, 154
 Influence factors, 58
 Ingress protection (IP) marking, 42
 Integrated circuit (IC), 38
 Interference (EMC), 148
 International protection (IP) marking, 42
 IP code, 42

ISO tolerance (technical drawing), 227

J

Junction temperature, 115

K

Kelvin, 80

Kirchhoff's law, 101

L

Label (circuit diagram), 22

Labeling of electronic components

colors, 234

letter, 235

Laminar flow, 94

Late failure, 53

Layered assembly technique, 37

Layout (of a circuit), 24

Leasing (electronic system), 201

Letter (circuit diagram), 22

Life cycle assessment, 215

Life cycle (electronic system), 198

Line style (technical drawing), 221

Line width (technical drawing), 221

Loading factors, 58

M

Magnetic coupling, 154

Magnetoquasistatic field, 168

Magnetostatic field, 167

Maintenance (circular economy), 199

Maintenance (reliability), 49

Marketing stage (product), 5

Material compatibility, 213

Material labeling, 215

Material recycling, 199

Mean time between failures (MTBF), 50, 56

Mean time to failure (MTTF), 50, 56

Minimum life-time, 65

Modular design, 36

Module (of electronic systems), 31, 35

Multi-chip module (MCM), 38

Multi-point ground, 160

N

Nested assembly technique, 37

Network nodes (thermal network), 86

Network plan, 15

Neutral conductor (N), 160, 189

Nominal dimension (technical drawing), 225

Normal distribution, 53

Nusselt number, 96

O

Operating point (fan), 111

Operating temperature of components, 115

Orthographic projection, 18

Overtemperature, 82

P

Panel-mounted device, 38

Paper size (technical drawing), 221

Parallel system/structure (reliability), 63, 68

Parasitic oscillation, 164

Partition panel effect (radiation), 105

Peltier effect, 113

Peltier element, 114

Perforation coefficient, 121

Permeability, 169

Pin assignment (IC), 232

Planned obsolescence, 199

Portable device, 38

Positional tolerance (technical drawing), 227

Power dissipation, 80

Power-supply elements, 39

Prandtl number, 97

Preferred numbers, 228

Printed circuit board (PCB), 39

Probability, 48

random event, 47

relative frequency, 47

Probability density function (PDF), 51

Probability of occurrence, 48

Processing function, 33

Processing layer (of electronic systems), 32

Production-based dimensioning, 225

Production waste recycling, 198

Product life cycle, 5

Product planning, 12

Product recycling, 199

Product requirement document, 13

Project structure plan, 15

Protection classes, 40

Q

Quasi-static field, 168

R

Radiation heat transfer, 98

Radiation heat transfer coefficient, 104

Radiation thermal resistance, 104

Random event (probability), 47

Random failure, 52

Rate of occurrence of failures (ROCOF), 65

Receptor (EMC), 148

Recycling, 193
 material, 199
 product, 199
 Recycling code, 215
 Recycling loop, 198
 Reduction factors, 58
 Redundancy, 63, 68
 cold, 63
 hot, 63
 Reference conductor, 189
 Reference ground, 157
 Reference stress, 57
 Regenerability, 202
 Relationships (of electronic systems), 34
 Reliability, 45, 49
 cost, 46
 Reliability function, 50, 55
 Renard series, 229
 Repair (reliability), 49
 Reparability, 202
 Return line/conductor, 162, 184
 Reynolds number, 97
 Right-angled parallel projection, 18
 Ripcord technique, 207
 Roughness (surface), 227

S

Sandwich assembly technique, 37
 Scale (technical drawing), 19, 220
 Scheduling, 15
 Schelkunoff impedance concept, 178
 Schematic (of a circuit), 22
 Sectional view (technical drawing), 20, 222
 Security function, 34
 Seebeck effect, 113
 Serial system/structure (reliability), 63, 66
 Set of drawings (of a system), 18
 Shielding, 165
 $\lambda/10$ rule, 180, 188
 absorption loss, 178
 electromagnetic field, 176
 electroquasistatic field, 175
 electrostatic field, 173
 magnetoquasistatic field, 170
 magnetostatic field, 168
 reflection loss (EMC), 178
 Shielding effectiveness (*SE*), 166
 Shielding factor (*S*), 166
 Simulation
 dynamic, 27
 finite-element, 27

Single-point ground, 159
 Skin depth, 172
 Skin effect, 171
 Source of disturbance (EMC), 148
 Specific thermal conductance, 91
 Stack assembly technique, 37
 Standard module design, 36
 Static field, 167
 Stress factors, 58
 Structural correctness, 206
 Structure (of electronic systems), 32, 34
 Suitability for disassembly (design), 204
 Suitability for disposal (design), 213
 Suitability for recovery (design), 211
 Suitability for separation (design), 210
 Suitability of materials, 204
 Suitability of quantities, 210
 Surface roughness, 227
 Surface specification (technical drawing), 227
 Surface temperature (enclosure), 117
 Survival function, 50
 Symbol (circuit diagram), 22
 System cabinet, 189
 System ground (*G*), 157, 189
 System impedance curve, 111, 141
 System levels, 38
 System pressure curve, 111, 141

T

Task definition, 12
 Technical drawing, 17
 Technical requirements document, 14
 Temperature, 80
 Temperature limit, 82
 Temperature source (thermal network), 87
 Test-based dimensioning, 225
 Thermal capacity, 81
 Thermal conduction, 90
 Thermal conductivity, 91
 Thermal convection, 94
 Thermal energy, 79
 Thermal glue, 110
 Thermal grease, 110
 Thermal interface material, 110
 Thermal network, 84, 86
 Thermal radiation, 98
 Thermal resistance, 81
 Thermosyphoning, 113
 Title block (technical drawing), 219
 Tolerances (technical drawing), 22
 Tolerance, tolerancing, 224

Transfer impedance, [176](#)

Triboelectric effect, [181](#)

Turbulent flow, [94](#)

U

Unreliability function, [50](#)

Upcycling, [212](#)

Useful life (electronic system), [199](#)

V

Victim (EMC), [148](#)

View factor, [107](#)

Views (technical drawing), [18](#)

Volumetric flow rate (fan), [141](#)

W

Waste management, [196](#)

Wearout failure, [53](#)

Weibull distribution, [54](#)

White body (radiation), [101](#)