

ACRONYMS AND ABBREVIATIONS

APPENDIX P

Electrical engineers are fond (*too* fond, some would say) of acronyms and abbreviations, a familiarity that every educated circuit designer must necessarily acquire. To assist in that education, and for handy reference, we here provide a lightly annotated list of terms used in this book.

ac: literally “alternating current” (i.e., alternating *voltage*); more generally a varying signal

AC(T): advanced CMOS (logic family)

A/D: analog-to-digital

ADC: analog-to-digital converter

ADI: Analog Devices Inc.

AES: Audio Engineering Society

AFC: automatic frequency control

AGC: automatic gain control

AGF: all-glass fiber

AHC(T): advanced high-speed CMOS (logic family)

ALS: advanced low-power Schottky (logic family)

ALU: arithmetic logic unit (in a processor)

ALV: advanced low-voltage (logic family)

AM: amplitude modulation

ANSI: American National Standards Institute

APD: avalanche photodiode

APF: all-plastic fiber

ARM: a popular processor architecture from ARM Holdings

ASIC: application-specific full-custom integrated circuit

ASCII: American Standard Code for Information Interchange

ASF: all-silica fiber

ASSP: application-specific standard product

ATA: advanced technology attachment (a disk interface; see PATA, SATA)

ATAPI: ATA packet interface (a generalized ATA)

ATE: automated test equipment

ATM: asynchronous transfer mode

ATSC: Advanced Television Systems Committee (digital TV standards)

AUC: advanced ultra-low-voltage CMOS (logic family)

AVC: advanced (low)-voltage CMOS (logic family)

AVR: a microcontroller family from Atmel Corp.

AWG: American wire gauge

AZ: auto-zero

BBM: break-before-make (switch)

BCD: binary-coded decimal

BGA: ball-grid array (an IC package)

BJT: bipolar junction transistor

BNC: bayonet Neill–Concelman (connector)

BPSK: binary phase-shifting keying

BRT: bias resistor transistor

BSS: broadcast satellite services

BV: breakdown voltage

BW: bandwidth

C0G: low tempco (stable) ceramic dielectric

CA: conditional access

CAN: controller area network (bus)

CANH: controller area network high (a CAN signal)

CANL: controller area network low (a CAN signal)

CBR: constant bitrate (coding)

CCD: charge-coupled device

CCFL: cold-cathode fluorescent lamp

CCM: continuous-conduction mode (in a power converter)

CD: compact disc (optical storage)

CDMA: code-division multiple access

CDR: clock and data recovery

CES: Consumer Electronics Show

CF: compact flash (memory card)

CFB: current feedback (op-amp)

CHE: channel hot-electron

CLB: configurable logic block

CML: current-mode logic

CMOS: complementary metal-oxide semiconductor

CMRR: common-mode rejection ratio

codec: coder–decoder

cPLD: complex programmable-logic device

CPU: central processing unit

CR: carriage return

CRC: cyclic redundancy checksum

CRT: cathode-ray tube

CSMA: carrier-sense multiple-access

CSP: chip-scale package

CTR: current transfer ratio	eSATA: external SATA interface
CTS: clear to send (in a serial link)	ESD: electrostatic discharge
CVBS: composite video, blanking, and sync	ESL: equivalent series inductance
CVSD: continuously variable-slope delta-modulation	ESR: equivalent series resistance
DA: dielectric absorption	ETF: 8-to-14 (digital coding)
D/A: digital-to-analog	FCC: Federal Communications Commission
DAC: digital-to-analog converter	FDNR: frequency-dependent negative resistor
DAQ: data-acquisition system	FED: field-emission display
DBS: direct broadcast satellite	FET: field-effect transistor
dc: direct current (i.e., a fixed voltage)	FFS: fringe-field switching (an LCD display technology)
DCE: data communications equipment (in a serial link)	FFT: fast Fourier transform
DCM: discontinuous-conduction mode (in a power converter)	FG: floating gate
DDR: double data rate (memory)	FGA: floating-gate array
DDS: direct digital synthesis	FIFO: first-in-first-out (memory)
DFC: digital frequency converter	FIR: finite-impulse-response (filter)
DIN: Deutsches Institut für Normung (a German standards organization); a connector series	FM: frequency modulation
DIP: dual in-line package	F-N Fowler–Nordheim tunnelling
DIR: direction (a control signal)	FOT: fiber-optic transceiver
DMA: direct memory access	FPBW: full-power bandwidth
DMM: digital multimeter	FPGA: field-programmable gate array
DNL: differential nonlinearity	FR-4: “flame-retardant 4” (glass-epoxy PCB material)
DPCP: display-port content protection	FRAM (also FeRAM, F-RAM): ferroelectric random-access memory
DPDT: double-pole double-throw (switch)	FSB: front-side bus (of a computer processor)
DRAM: dynamic random-access memory	FSE: full-sunlight equivalent (you saw it here first!)
DSBGA: die-size ball-grid array (an IC package)	GAL: generic array logic
DSL: digital subscriber line (for data over telephone line)	GBP, GBW: gain-bandwidth product
DSP: digital signal processing (or processor)	GCC: GNU C-compiler
DSR: data set ready (in a serial link)	GCPW: grounded coplanar waveguide
DTE: data terminal equipment (in a serial link)	GDT: gas-discharge tube
DTH: direct-to-home (satellite TV)	GIC: generalized impedance converter
DTL: diode–transistor logic	GMR: giant magnetoresistance
DTR: data terminal ready (in a serial link)	GND: ground
DUT: device under test	GPIO: general-purpose interface bus
DVI: digital visual interface (for digital video)	GPL: graphical programming language; general public license (in GNU)
DVM: digital voltmeter	GPS: global positioning system
DVR: digital video recorder	GPU: graphics-processor unit
EAROM: electrically alterable read-only memory	GUI: graphical user interface
EAS: avalanche energy specification	HAPD: hybrid avalanche photodiode (detector)
ECL: emitter-coupled logic	HBM: human body model
EEPROM: electrically erasable programmable read-only memory	HC(T): high-speed CMOS (logic family)
EIA: Electronic Industries Alliance (standards and trade organization)	HDCP: high-bandwidth digital content protection
EMF: electromotive force (\sim voltage)	HDD: hard-disk drive
EMI: electromagnetic interference	HDL: hardware description language
ENOB: effective number of bits	HDMI: high-definition multimedia interface (for digital display)
EPROM: erasable programmable read-only memory	HDTV: high-definition television
	HI: human interface

HP: Hewlett-Packard	LVDS: low-voltage differential signaling
HV: high voltage	LVPECL: low-voltage positive emitter-coupled logic
IC: integrated circuit	LVX: low-voltage crossvolt (logic family)
ICSP: in-circuit serial programming	LXI: LAN eXtensions for Instrumentation
IDC: insulation displacement connector	μ C: microcontroller
IDE: integrated development environment (for coding)	MAC: multiplier-accumulator; media-access control
IEC: International Electrotechnical Commission	MBB: make-before-break (switch)
IEEE: Institute of Electrical and Electronic Engineers	MCU: microcontroller unit
IF: intermediate frequency (in RF receiver)	MDAC: multiplying digital-to-analog converter
IGBT: insulated-gate bipolar transistor	MEMS: microelectromechanical system
IGFET: insulated-gate field-effect transistor	MFB: multiple-feedback (active filter)
IIC (I ² C): inter-integrated-circuit (a serial bus)	MIPS: mega-instructions per second
IIR: infinite-impulse-response (filter)	MLC: multilevel cell (in nonvolatile memory)
INA: instrumentation amplifier	MMU: memory management unit
INL: integral nonlinearity (in A/D conversion)	modem: modulator-demodulator
I/O: input-output	MOS: metal-oxide semiconductor
IP: Internet protocol; intellectual property	MOSFET: metal-oxide semiconductor field-effect transistor
IPS: in-plane switching (an LCD display technology)	MOV: metal-oxide varistor (surge protector)
IR: infrared	MPTS: multiprogram transport stream (in digital TV)
ISA: International Society of Automation (a standard-setting organization)	MPU: microprocessor unit
ISI: intersymbol interference	MRAM: magnetoresistive random-access memory
JFET: junction field-effect transistor	MRI: magnetic resonance imaging
JTAG: Joint Test Action Group (an IC interface)	MSB: most-significant bit
KCL: Kirchhoff's current law	MSI: medium-scale integration
KVL: Kirchhoff's voltage law	MUX: multiplexer
LAB: logic array block (in programmable logic)	NAN: not a number
LAN: local area network	NC: normally closed (switch)
LCD: liquid-crystal display	NECL: negative emitter-coupled logic
LCX: low-voltage CMOS crossvolt (logic family)	NEMA: National Electrical Manufacturers Association (a standards-setting organization)
LDO: low-dropout (linear voltage regulator)	NIC: negative-impedance converter; network interface card
LE: logic element (in programmable logic)	NiCd: nickel cadmium (battery)
LED: light-emitting diode	NiMH: nickel metal-hydride (battery)
LFSR: linear feedback shift register	NIST: National Institute of Standards and Technology
LIFO: last-in first-out (memory)	NMI: nonmaskable interrupt
Li-ion: lithium ion (battery)	NMR: nuclear magnetic resonance
LIN: local-interconnect network (bus)	nMOS: n-type metal-oxide semiconductor
LNA: low-noise amplifier	NO: normally open (switch)
LNBF: low-noise block-downconverter plus feed (for satellite TV)	NP0: low tempco (stable) ceramic dielectric
LO: local oscillator (in RF receiver)	NRZ: nonreturn to zero (data code)
LPF: lowpass filter	NRZI: nonreturn to zero inverted (data code)
LPT: line printer (a parallel port)	NSC: National Semiconductor Corporation (now part of TI)
LS: low-power Schottky (logic family)	NTC: negative temperature coefficient
LSB: least-significant bit	NTSC: National Television System Committee (analog TV standard)
LSI: large-scale integrated circuit	NV: nonvolatile
LUT: lookup table	
LV: low-voltage (logic family)	
LVC: low-voltage CMOS (logic family)	

NVM: nonvolatile memory	PRBS: pseudorandom bit sequence
O/C: open-collector (logic output)	PROM: phase-change read-only memory
OCXO: oven-controlled crystal oscillator	PSRAM: pseudostatic random-access memory
O/D: open-drain (logic output)	PSRR: power-supply rejection ratio
OEM: original equipment manufacturer	PTAT: proportional to absolute temperature
OLED: organic light-emitting diode	PUJT: programmable unijunction transistor
op-amp: operational amplifier	PV: photovoltaic (light detector)
OSI: open systems interconnection (network hierarchy)	PVC: polyvinyl chloride (insulator)
OSR: oversampling ratio	PVR: personal video recorder
OTA: over-the-air (broadcasting)	PWM: pulse-width modulation
OTP: one-time-programmable NV memory	QAM: quadrature amplitude modulation
PAL: programmable array logic	QPSK: quadrature phase-shift keying
PARC: Palo Alto Research Center	RAM: random-access memory
PATA: parallel ATA interface	RCO: ripple-clock output
PC: printed circuit; personal computer	RD: receive data (in a serial link)
PCB: printed circuit board	RF: radiofrequency
PCF: plastic-clad fiber	RFI: radiofrequency interference
PCI: peripheral component interface (a computer bus)	RG-xx: "Radio Guide" (coax cable designators)
PCIe (also PCI-E): extended peripheral component interface	RGB: red-green-blue (video signals)
PCM: pulse-code modulation	RISC: reduced instruction set computing
PCMCIA: Personal Computer Memory Card International Association (a card interface standard) ¹	RLL: run-length limited (digital codes)
PDA: personal digital assistant	rms: root-mean-square
PECL: positive emitter-coupled logic	ROM: read-only memory
PEN: polyethylene naphthalate (a capacitor dielectric)	RRI: rail-to-rail input
PFC: power-factor correction (in ac-powered converters)	RRIO: rail-to-rail input and output
PFD: phase-frequency detector	RRO: rail-to-rail output
PFM: pulse-frequency modulation	RTC: real-time clock
PGA: programmable gain amplifier	RTD: resistance temperature detector (or resistive temperature device)
PID: proportional-integral-differential (in control systems); program identifier (in digital TV)	RTI: referred to the input
PIN: positive-intrinsic-negative (diode)	RTL: resistor-transistor logic; register-transfer level (in an HDL)
PI/PO: parallel-in-parallel-out	RTO: referred to the output
PIR: passive infrared (detector)	RTS: request to send (in a serial link)
PIV: peak inverse voltage	SA: sense amplifier
PLA: programmable logic array	SACD: Super Audio compact disc
PLC: powerline cycles	SAD: silicon avalanche device (i.e., a zener TVS)
PLD: programmable logic device	SAR: successive approximation register
PLL: phase-locked loop	SAS: serial attached SCSI (interface)
pMOS: p-type metal-oxide semiconductor	SATA: serial ATA (interface)
PMT: photomultiplier tube	SAW: surface acoustic-wave
POF: plastic optical fiber	SBC: single-board computer
POL: point-of-load	SC: subscriber connector (a fiber-optic connector)
pp: peak-to-peak (voltage)	SCPI: Standard Commands for Programmable Instruments
PPS: polyphenylene sulfide (a capacitor dielectric)	SCR: silicon-controlled rectifier
PRAM: phase-change random-access memory	SCSI: small computer system interface
	SD: secure digital (memory card)
	SDI: serial data in

¹ Whose awkwardness spawned jokes like "Personal Computer Manufacturers Can't Invent Acronyms."

SDO: serial data out	TD: transmit data (in a serial link)
SDR: single data rate (memory)	tempco: temperature coefficient
SDRAM: synchronous dynamic random-access memory	THD: total harmonic distortion
SDTV: standard-definition television	TI: Texas Instruments
SE: single-ended	TNC: threaded Neill-Concelman (connector)
SED: surface-conduction electron-emitter display	TO: transistor outline (e.g., TO-92, TO-220)
SEPIC: single-ended primary-inductance converter	TSSOP: thin-shrink small-outline package
SERDES: serializer–deserializer	TTL: transistor–transistor logic
S/H: sample-and-hold	TVS: transient voltage suppressor
SHV: “safe high voltage” (connector)	TWI: two-wire interface (a serial bus)
SI: serial input	UART: universal asynchronous receiver-transmitter
SIP: single in-line package	UDP: user datagram protocol (an Internet protocol)
SMA, SMB, SMC: subminiature RF coax connector series	UHF: ultrahigh frequency; also a legacy coaxial connector
SMI: small media interface (a fiber-optic connector)	UL: Underwriters Laboratories (a safety certification company)
SMPS: switch-mode power supply	UPS: uninterruptible power supply
SMT: surface-mount technology	USB: universal serial bus (a data interface)
SMU: source-measure unit	UTP: unshielded twisted pair (cable)
SNR: signal-to-noise ratio	UV: ultraviolet
SO: serial output; small-outline (IC package)	VBR: variable bitrate (coding)
SOA: safe-operating area	VCO: voltage-controlled oscillator
SODIMM: small-outline dual-in-line memory module	VCVS: voltage-controlled voltage-source (active filter)
SOIC: small-outline integrated circuit	VCXO: voltage-controlled crystal oscillator
SOT: small-outline transistor	VDE: Verband der Elektrotechnik, Elektronik und Informationstechnik (a German organization whose activities include safety standards)
SPDIF: Sony–Philips Digital Interconnect Format (for digital audio)	V/F: voltage-to-frequency (converter)
SPICE: “simulation program with integrated circuit emphasis” (analog circuit simulator software)	VFB: voltage feedback
SPDT: single-pole double-throw (switch)	VFD: vacuum fluorescent display
SPI: serial peripheral interface (a simple IC bus)	VGA: video graphics array (640×480 analog video)
SPL: sound pressure level	VHS: video home system (video recording)
sPLD: simple programmable logic device	VLSI: very-large-scale integration
SPST: single-pole single-throw (switch)	VME: VERSAmodule Eurocard Bus (a card interface)
SPTS: single-program transport stream (in digital TV)	VOD: video-on-demand
SR: slew rate	VOM: volt-ohm-millimeter
SRAM: static random-access memory	VSWR: voltage standing-wave ratio (on a transmission line)
SSD: solid-state drive (an NV memory)	VU: volume unit (an audio level)
SSH: secure shell (a network protocol)	WL: write latency (in computer memory)
SSP: synchronous serial port	X7R: a ceramic dielectric
SSR: solid-state relay	XLR: a professional audio connector series
ST: straight tip (a fiber-optic connector)	XO: crystal oscillator
STB: set-top box (for cable or satellite TV)	Y5V: a ceramic dielectric
STP: shielded twisted pair (cable)	YIG: yttrium–iron garnet
SWR: standing-wave ratio (on a transmission line)	Z5U: a ceramic dielectric
T&M: test and measurement	ZCS: zero-current switching
TAC: time-to-amplitude conversion	ZVS: zero-voltage switching
TBH: take-back-half (a control algorithm)	
TCP: transmission control protocol (an Internet protocol)	
TCXO: temperature-compensated crystal oscillator	