Electronics I Glossary

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***Abstract*—This glossary contains definitions of useful terms in electronics. Please note that all terms are numbered except for the 26 NATO phonetic alphabet terms, which should be included in the total number of words.**

ALFA

1) Active Region
   The area of a transistor I-V curve where current no longer increases with an increased voltage. Power is dissipating, quiescence achieved

2) Admittance
   The reciprocal of impedance denoted by Y; measured in siemens.

3) Anode
   A negatively polarized electrode, pin, or terminal.

4) Astable Multivibrator
   A positive feedback device that utilizes hysteresis and transient response to generate a tuneable square wave from a DC input.

BRAVO

5) Bandpass Filter
   A type of electronic filter that allows a selected range of frequencies to pass through.

6) Bandreject Filter
   A type of electronic filter that only blocks a selected range of frequencies from passing through.

7) Bandwidth
   The size of a defined range of frequencies.

8) Base
   The terminal of a bipolar junction transistor that controls the open and closed switch behavior.

9) Biasing
   A method to set voltages or currents in certain areas of a circuit to predetermined values.

10) Bipolar
    When + and - references are used at the rails. There is a common ground.

11) Bipolar Junction Transistor
    A type of semiconducing transistor.

12) Biquadratic (Biquad)
    $H(z) = \frac{b_0+b_1z^{-1}+b_2z^{-2}}{a_0+a_1z^{-1}+a_2z^{-2}}$

13) Bode Plot
    A logarithmic scale graph showing gain vs. frequency.

14) Boltzmann's Constant (k or k_B)
    A constant ($1.380649 \times 10^{-23} J \cdot K^{-1}$) that relates thermal energy to temperature.

15) Brain Box
    A colloquial term for an Engine Control Module (ECM).

16) Buffer
    A type of circuit isolator, i.e unity gain follower

17) Bulk Capacitor
    A capacitor used to prevent the output of a power supply from dropping too low.

18) Bypass Capacitor
    A Bypass Capacitor is a capacitance that shorts AC signals to ground, so that any AC noise that may be present on a DC signal is removed, producing a much cleaner and pure DC signal. Usually about $0.1\mu F$

CHARLIE

19) C
    The speed of ligaht $3 \times 10^8 m/s$

20) Capacitor
    A passive transient linear device that stores energy in an electric field.

21) Cathode
    A positively polarize electrode, pin, or terminal

22) Center Tap Transformer
    A tranformer that with a central comamon terminal: offering a positive and negative voltage on either side with equal magnitude.

23) Clamp Diodes
    A diode that is used to force a voltage on the anode.

24) Charge of an Electron (q)
    $1.602 \times 10^{-19} C$

25) Collector
The positive terminal of a BJT.

26) Common Base Amplifier (Grounded Base)
A basic BJT amplifier topology in which the base terminal is grounded. Current gain is unity and voltage gain is proportional to the value of the resistor between the rail and the output.

27) Common Cathode Amplifier
The tube equivelant of a common emitter amplifier.

28) Common Collector Amplifier
A basic single-stage BJT amplifier where the collector terminal is directly connected to a power rail or ground. On common collector amplifiers, voltage gain is very low (around unity) while current gain remains high around h_{FE}.

29) Common Emitter Amplifier
A simple single-stage BJT amplifier where the emmiter terminal is directly connected to a power rail or ground. They have high current gain and are usually used to amplify voltage. The output is typically phase-shifted by $180°$.

30) Common Grid
The tube equivelant of a common base amplifier.

31) Common Mode Rejection Ratio (CMRR)
$CMRR = 20 \log_{10} \left(\frac{A_d}{A_{cm}} \right)$

32) Common Path
A shared (common) ground reference.

33) Common Plate (Common Anode)
The tube equivelant circuit of a common collector amplifier.

34) Complementary Metal-Oxide-Semiconductor (CMOS)
A type of MOSFET fabrication process that consists of N-type and P-type MOSFETs working together to create digital logic functions. It is the most VLSI technique.

35) Controller Area Network (CAN Bus)
A standard device interconnect for multiplexed wiring. It is primarily used for wiring devices in vehicles.

36) Conductance
The reciprocal of resistance, denoted by G; measured in siemens.

37) Control Grid
The terminal of a tube device that controls the flow of electrons between the cathode and anode via an applied voltage.

38) Coulomb (C)
The base SI unit of charge.

39) Cut-off
The area of a transistor I-V curve where there is no current

DELTA

40) Darlington pair
A pair of BJTs arranged in such a way that the total current gain is $\beta_{pair} = \beta_1 \cdot \beta_2$.

41) DC Restorer
Also known as a clamper, not to be confused with a voltage clamp, a DC restorer is a type of electronic circuit that shifts an AC signal to be completely positive or negative and maintains that V_{max} or V_{min} is 0.

42) Delta Configuration (Δ Configuration)
Three resistors arranged along the edges of a triangle. It can be transformed into a y-configuration using the following method:

$R_A = \frac{R_{AB} R_{AC}}{R_{AB} + R_{AC} + R_{BC}}$

$R_B = \frac{R_{AB} R_{BC}}{R_{AB} + R_{AC} + R_{BC}}$

$R_C = \frac{R_{AC} R_{BC}}{R_{AB} + R_{AC} + R_{BC}}$

43) Dielectric
A material that increases the affect of an electric field: often used to increase capacitance. Typically denoted by a κ

44) Differential Amplifier
A two-input amplifying device with the transfer function: $V_o = A_d(V_+ - V_-) + A_c \frac{V_+ - V_-}{2}$, where A_d is the differential gain, and A_c is the common mode gain,

45) Differential Pair
A signal that is sent over two wires simultaneously as an inverted and non-inverted signal. It is used to increase signal voltage and reject common-mode noise.

46) Diode
A two terminal device that allows current to travel in only one direction.

47) Diode Thermal Voltage
The voltage across a diode's PN junction caused by thermal motion of electrons. The thermal voltage is defined as $V_T = \frac{kT}{q}$; where k is Boltzmann's constant, T is the temperature in Kelvin, and q is the absolute value of the charge of an electron.

48) Distributed Parameter
A component with properties along a length or area rather than localized at a point. Must be used to model a component when the component is not much smaller than one wavelength.

49) Drain
The terminal of a MOSFET where current flows out towards the common path.

50) Dynatron Region (Tetrode Kink)
The operating regime of a tetrode where the device exhibits negative resistance behavior.

ECHO

51) Early Voltage (V_A)
A characteristic property of a MOSFET device determined by the drain current and small signal output conductance.

52) Edison Effect
The thermionic effect by which electrons are transmitted from a hot cathode into a vacuum.

53) Electromagnetic Interference EMI
Also called radio-frequency interference (RFI) when in the radio frequency spectrum, is a disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling, conduction, or radiation.

54) Electrolytic Capacitor
A type of polarized capacitor that uses an electrolyte and oxide layer to increase the dielectric constant.

55) Electronic Design Automation (EDA)
Specialized software used to design and simulate electronic devices

56) Emitter
The common path terminal of a BJT.

57) Energy Assurance Plan (EAP)
A plan to make energy infrastructure more reliable and secure.

FOXTROT

58) Semiconductor Fabrication Plant (Fab)
A high-tech factory where semiconductor devices are manufactured.

59) Farad
The base SI unit for capacitance.

60) Filter
A circuit that only allows certain frequencies through.

61) Flyback Diode
Also known as a clamp diode, a flyback diode is a use case for the clamping property of diodes, where the flyback voltage from an inductor is supressed.

62) Forward Voltage
The voltage at which a semiconducing device begins to conduct.

63) Fudge Factor
An extra term added to an equation to correct a result.

64) Full Wave Rectifier
A device that restricts the output voltage to one pole and inverts the sign of the opposite pole.

GOLF

65) Gain
A logarithmic measure of amplification.

66) Gate-to-source Voltage (V_{GS})
The voltage between the gate and the source of a MOSFET, responsible for controlling the switch state.

67) General Interconnect
A two-way electrical connection between two circuit components.

68) Giga-
The metric prefix meaning one billion (10^9) times the base unit.

HOTEL

69) Harmonic Distortion
A type of distortion that creates large spikes in gain at the harmonics (natural number multiples) of a frequency.

70) Half Wave Rectifier
A device that restricts the output voltage to one pole.

71) High side switch
A type of switch where the switching device is between the supply and the rest of the circuit.

72) High Pass Filter
A filtering device that attenuates frequencies below a cut-off value (ω_0) and does not affect signals above the cut off point.

73) Hysteresis
Non-symmetric switching behavior of a circuit;

the point of switching on is different from the point of switching off.

INDIA

74) Impedance
The complex measure of resistance. Impedance is denoted by Z, in ohms, and is defined by the complex relationship $Z = R + jX$.

75) Insulated Gate Bipolar Transistor (IGBT)
A type of transistor designed for high current applications.

76) Integrated Circuit (IC)
A self-contained pre-manufactured circuit on a chip. They usually come in some kind of enclosure with an array of pins to interface with.

77) Integrator
An amplifier topology where the output voltage is the integral of the input signal with respect to time.

78) Interconnect
A circuit component responsible for electrical connections between components.

79) Interconnect Shielding
A component of an interconnect used to minimize EMI noise in the signal.

80) Intermodulation Distortion
A type of distortion caused by nonlinear signal processing behavior. It notably causes amplitude spikes at the harmonic frequencies as well as sum and difference frequencies of an input signal with multiple frequencies.

JULIETT

81) Junction Field Effect Transistor (JFET)
A simple type of FET device that can be used as a switch or combined with resistors to build an amplifier.

KILO

82) Kelvin Leads
A clip, often a crocodile clip, that connects a force-and-sense pair to measure very low resistances using four-terminal sensing.

83) Kilo-
The metric prefix meaning one thousand (10^3) times the base unit.

LIMA

84) Length of Channel (L)
The lenth of a MOSFET channel; the dimension spanning the source and drain.

85) Light Emitting Diode (LED)
A type of diode that emits light when the forward voltage is reached. The forward voltage, V_F is dependtent on the color of the LED; specific values can be seen in the table below:

Color	**Wavelength**	V_F
UV	$<$400nm	3.1 - 4.4
Violet	400nm - 450nm	2.8 - 4.0
Blue	450nm - 500nm	2.5 - 3.7
Green	500nm - 570nm	1.9 - 4.0
Yellow	570nm - 590nm	2.1 - 2.2
Orange	590nm - 610nm	2.0 - 2.1
Red	610nm - 760nm	1.6 - 2.0
IR	$>$760nm	$>$1.9

86) Low pass filter
A type of AC filter that eliminates high frequencies.

87) Low side switch
A type of switch where the switching device is placed between the main circuit and the common path.

88) Lumped Parameter
A simplification technique that lumps device properties into a point-like object.

MIKE

89) Mega-
The metric prefix meaning one million (10^6) times the base unit.

90) Memcapacitor
A passive circuit element whose capacitance is voltage and charge dependent.

91) Meminductor
A passive circuit device whose inductance is dependent on current or flux.

92) Memristor
A charge dependent resistor with the behaviour $V(t) = M(q(t))I(t)$.

93) Metal Oxide Varistor (MOV)
A type of varistor made from sintered ceramic metal-oxide materials.

94) Micro-
The metric prefix meaning one millionth (10^{-6}) of

the base unit.

95) Milli-
The metric prefix meaning one thousandth (10^{-3}) of the base unit.

96) MOSFET
Metal Oxide Semiconducting Field Effect Transistor. Voltage (V_{GS}) controls the current (I_D).

NOVEMBER

97) Nano-
The metric prefix meaning one billionth (10^{-9}) of the base unit.

98) Negative Feedback
A way to control the output behaviour of an operational amplifier by feeding the output into the inverting terminal. Passive devices may optionally be present between the output and inverting terminal to change the output behaviour further.

99) Noise
Signal disturbances that are not part of an intentional signal.

100) Noise Figure
The noise difference between an actual device and an ideal device with the same gain and bandwidth; measured in decibels.

101) Normalized response

OSCAR

102) Ohm (Ω)
The base SI unit of resistance.

103) Omega (ω)
Symbol indicating angular frequency

104) Operational Amplifier (Op-Amp)
An active device that enables isolation, comparison, and amplification.

105) Over Voltage (V_O)
When $V_{GS} - V_t > 0$.

106) Oxide Capacitance (C_{OX})
The capacitance of the oxide layer of a MOSFET.

107) Oxide Thickness (t_{OX})
The thickness of the oxide layer of a MOSFET.

PAPA

108) Pentode
A five-terminal power vacuum tube device with an anode/plate (P), cathode (K), control grid (G1), screen grid (G2), and suppressor (G3).

109) Phase Splitter
A device that splits an input signal into two output signals with a phase offset of $180°$.

110) Photoelectric Effect
A material phenomenon in which a voltage is generated when exposed to light.

111) Pico-
The metric prefix meaning one trillionth (10^{-12}) of the base unit.

112) Positive Feedback
In the context of an operational amplifier, it implies some kind of connection from the output terminal to the non-inverting input.

113) Power Supply
A nonlinear circuit that can reliably supply a specific voltage or specific current.

114) Power Supply Distribution

115) Push-Pull Configuration
A basic circuit shape that uses a pair of active devices to enhance load capacity and switching speed.

QUEBEC

116) Quiescent
When a device is dissapating power without a signal input.

ROMEO

117) Rectification
Forcing polarity on a signal.

118) Reactancea
The complex part of an impedance; measured in ohms.

119) Resistance
The measure of how much voltage is required to drive an electric current through an object; measured in ohms;

120) Resistor
A purely resistive linear device with no transient properties.

121) Rheostat
A type of variable resistor used to control power.

SIERRA

122) Sallen-Key LPF Circuit
A 2-pole circuit with a non-inverting amplifier.

123) Saturation (for BJTs)
The regime of operation for BJTs where increasing V_{BE} increases I_C.

124) Saturation (for MOSFETs)
The regime of operation for MOSFETs where V_{GS} is positive and increasing V_DS does not affect I_D

125) Schottky Diode
A low forward voltage, high switching speed, high reverse leakage current diode.

126) Screen Grid
A terminal found on tetrode and pentode tubes used to decrease the effects of grid-to-plate capacitance.

127) Shielding
A piece of metal, wrapped around a wire or electronic device used to minimize EMI noise and radiation.

128) Silicon Diode
A type of low-power diode made of silicon. Forward voltage (V_F) is 0.6 to 1.0 volts with 0.7 volts being quite common. The reverse breakdown voltage of a silicon diode is usually several tens of volts (70v to 100v is common),

129) Summing Amplifier
A type of amplifier that adds voltages: can be inverting or non-inverting

130) Suppressor Grid
A terminal added to a tetrode to create a pentode and eliminate the dynatron (negative resistance) regime of operation.

131) Susceptance
The reciprocal of reactance; measured in siemens.

TANGO

132) Temperature (T)
The total kinetic energy of a system. It often affects the behaviour of devices, notably resistors, diodes, and transistors.

133) Tetrode ("Space Charge" Tube)
A four-terminal power tube device with a negative resistance regime. Its four terminals are the anode/plate (P), the cathode (K), the control grid (G1), and the screen grid (G2).

134) Thermal Model Electronics
A way to model the thermal behavior of electronic devices using circuit schematic symbols.

135) Threshold Voltage (V_t)
The minimum V_{GS} required to turn a MOSFET on.

136) Transformer
An inducting device that can step up or step down AC voltage while having little power loss.

137) Transistor
A three terminal, active, semiconducing device that acts as an electronic switch.

138) Triaxial Cable
A cable with three concentric conductors used to minimize EMI.

139) Triode (Audion Tube)
A voltage controlled current source tube device with three terminals: the cathode, the anode, and the gate.

140) Triode Region
The operating regime of a MOSFET where increasing V_{DS} increases I_D. It is also the name of a power-hungry tube device with amplifying properties.

141) Tube (Vacuum Tube)
A power electronics device that operates within a glass enclosure with all air evacuated. The device uses the heat generated to eable its behavior. These devices are often characterized by their distinct orange glow.

142) Twisted pair
Two wires wrapped around one another to minimize loop area, thereby decreasing EMI.

UNIFORM

143) Unipolar
Simply a single supply voltage and ground reference. As opposed to Bipolar with + and - supply voltages.

VICTOR

144) V-I Response
A visual comparison of the voltage and current response of an electronic device.

145) Varistor (Voltage Dependent Resistor (VDR))
A non-ohmic, nonlinear resistive device that exhibits high resistance at lower voltages and low resistance at higher voltages.

146) Very Large-Scale Integration (VLSI)
The process by which millions or billions of CMOS devices are combined into a single IC.

147) Virtual Ground
A voltage that is very close to ground caused by amplifier feedback.

148) Voltage Swing
The difference between maximum output voltage and minimum output voltage. It acts as a way of measuring how close to a rail output voltage can be driven.

WHISKEY

149) Width of Channel (W)
The width of a MOSFET channel.

150) Williamson Amplifier
A famous high-fidelity tube-based audio amplifier.

X-RAY

YANKEE

151) Y-Configuration (Wye Configuration)
Three resistors meeting at a junction. It can be transformed into a delta configuration using the following method:

$$R_{AB} = \frac{R_A R_B + R_A R_C + R_B R_C}{R_C}$$

$$R_{AC} = \frac{R_A R_B + R_A R_C + R_B R_C}{R_B}$$

$$R_{BC} = \frac{R_A R_B + R_A R_C + R_B R_C}{R_A}$$

ZULU

152) Zener Diode
A special type of diode with a set reverse breakdown voltage.

153) Zener Shunt Regulator
A type of power regulator that clamps voltage using a Zener Diode.