# Glossary of Automotive Electronic Terms—SAE J1213

Information Report
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Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

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PREPRINT

# GLOSSARY OF AUTOMOTIVE ELECTRONIC TERMS—SAE J1213

**Information Report**

Report of Electronic Systems Committee approved June 1978.

**Active Element**—A component capable of producing power gain such as a transistor, tunnel diode, thyristor, etc. Also active device, active component.

**Active Filter**—A device employing passive network elements and amplifiers used for transmitting or rejecting signals in certain frequency ranges or for controlling the relative output of signals as a function of frequency. (GRAF)

**Ambient Conditions**—The conditions (pressure, temperature, etc.) of the surrounding medium.

**American Wire Gauge**—Abbreviated AWG. System of numerical designations for wire size, based on specified ranges of circular mil area. American Wire Gauge starts with 4/0 (0000) at the largest size going to 3/0 (000), 2/0 (00), 1/0 (0), 1, 2, and up to 40 and beyond for the smallest sizes.

**Ampere (A)**—The standard unit for measuring the strength of an electric current. The rate of flow of a charge in a conductor or conducting medium of one coulomb per second.

**Amplifier**—A device, circuit, or component which produces as an output an enlarged reproduction of the essential features of its input.

**Amplitude Modulation (AM)**—Modulation in which the amplitude of a wave is the characteristic subject to variation. (GRAF)

**Anode**—The positive pole (+) in batteries, galvanic cells, or plating apparatus. In diodes, the positive lead.

**Analog**—Of or pertaining to the general class of devices or circuits in which the output varies as a continuous function of the input.

**Analog Computer**—A computer which represents numerical quantities as electrical and physical variables and manipulates these variables in accomplishing solutions to mathematical problems.

**And Gate**—A combinational logic element such that the output channel is in its one state, if and only if each input channel is in its *one* state.

**Avalanch Breakdown**—In a semiconductor diode, a nondestructive breakdown caused by the cumulative multiplication of carriers through field-induced impact ionization. (GRAF)

**Avalanche Diode**—Also called breakdown diode. A silicon diode that has a high ratio of reverse-to-forward resistance until avalance breakdown occurs. After breakdown the voltage drop across the diode is essentially constant and is independent of the current. Used for voltage regulating and voltage limiting. Originally called zener diode before it was found that the Zener effect had no significant role in the operation of diodes of this type.

**Bandwidth**—The range within the limits of a Band. The least frequency interval of a wave form. The range of frequencies of a device, within which its performance, with respect so some characteristic, conforms to a specified standard.

**Bit**—The smallest element of information in binary language. A contraction of BInary digiT. These characters in system (computer) language signify "on" and "off" (1 and 0). Word length, memory capacity, etc. can be expressed in number of "bits".

**B-Multiplier**—See Darlington Amplifier.

**Barrier Layer**—See Depletion Layer.

**Base**—(transistor) A region that lies between an emitter and a collector of a transistor and into which minority carriers are injected. (IEEE)

**Base Resistance**—Resistance in series with the base lead in the common T equivalent circuit of a transistor. (GRAF)

**Battery**—A DC voltage source which converts chemical, nuclear, thermal or solar energy into electrical energy. (GRAF)

**Bidirectional Diode-Thyristor**—A two-terminal thyristor having substantially the same switching behavior in the first and third quadrants of the principal voltage-current characteristic. (IEEE)

**Bias**—To influence or dispose to one direction, as, for example, with a direct voltage or with a spring. (IEEE)

**Binary**—A characteristic or property involving a selection, choice, or condition, in which there are but two possible alternatives.

**Bipolar**—Having to do with a device in which both majority and minority carriers are present. In connection with ICs, the term describes a specific type of construction; Bipolar and MOS are the two most common types of IC construction. (GRAF)

**Bleeder Resistor**—A resistor used to draw a fixed current. Also used to discharge a filter capacitor after the circuit is de-energized. (GRAF)

**Boolean Algebra**—The Algebra of Logic named for mathemetician George Boole using alphabetic symbols to stand for logical variables and "zero" and "one" to represent states. AND, OR, NOT, are the three basic logic operations in this Algebra. NAND and NOR are combinations of the three basic operations.

**Breakdown Voltage**—See dielectric strength.

**Capacitance (C)**—In a system of conductors and dielectrics, that property which permits the storage of electrically separated charges when potential differences exist between the conductors.

Its value is expressed as the ratio of a quantity of electricity to a potential difference (Q/V). (IEEE)

**Capacitor**—(condenser) A device consisting of two electrodes separated by a dielectric, which may be air, for introducing capacitance into an electric circuit. (IEEE)

**Carrier**—An AC voltage having a frequency suitably high to be modulated by electrical signals.

**Cascade**—An arrangement of two or more similar circuits or amplifying stages in which the output of one provides the input of the next. (GRAF)

**Cathode**—A general name for any negative electrode. (GRAF)

**Cathode-Ray Tube**—An electron-beam tube in which the beam can be focused to a small cross section on a luminescent screen and varied in position and intensity to produce a visible pattern. (IEEE)

**Chip**—A single substrate on which all the active and passive elements of an electronic circuit have been fabricated. A chip is not ready for use until it is packaged and provided with terminals for connection to the outside world. Also called a die. (GRAF)

**Chip Sets**—A term describing the microprocessor chip in addition to RAMs, ROMs, and interface I/O devices. Chip sets, mounted on a board, are also referred to as the CPU portion of the microcomputer.

**Clock**—A device that generates periodic signals used for synchronization. (IEEE)

**Coil**—See Inductor.

**Collector**—(transistor) A region through which primary flow of charge carriers leaves the base. (IEEE)

**Common Collector Amplifier**—A transistor amplifier in which the collector element is common to both the input and output circuit. Also known as an emitter – follower and a grounded-collector amplifier. (GRAF)

**Common Mode Rejection**—A measure of how well a differential amplifier ignores a signal which appears simultaneously and is in phase at both input terminals. Also, called in-phase rejection. (GRAF)

**Complementary MOS**—Pertaining to n – and p – channel enhancement – mode devices fabricated compatibly on a silicon chip and connected into push-pull complementary digital circuits. These circuits offer low quiescent power dissipation and potentially high speeds, but they are more complex than circuits in which only one channel type is used. Abbreviated CMOS. (GRAF)

**Computer**—Any device capable of accepting information, applying prescribed processes to the information, and supplying the results of the process.

**Conductivity**—The ability to transmit heat or electricty. Electrical conductivity is expressed in terms of the current per unit of applied voltage. The reciprocal of resistivity.

**Constant Current Source**—A regulated source which acts to keep its output current constant in spite of changes in load, line, or temperature while the output voltage changes by whatever amount is necessary to maintain the constant output current. (GRAF)

**Continuous Rating**—The rating applicable to specified operation for a specific uninterrupted length of time.

**Central Processing Unit (CPU)**—The section of a computer that contains

The $\phi$ symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

the arithmetic, logic, and control circuits. In some systems it may also include the memory unit and the operator's console. Also called main frame.

**Creep**–A change in output occurring over a specific time period while the input and all environmental conditions are held constant.

**Critical Damping**–The value of damping which provides the most rapid transient response without overshoot. Operation between underdamping and overdamping. (GRAF)

**Current Density**–The amount of electric current passing through a given cross-sectional area of a conductor. (GRAF)

**Damping**–The transitory decay of the amplitude of a free oscillation of a system, associated with energy loss from the system. (IEEE)

**Damping Ratio**–The ratio of the degree of actual damping to the degree of damping required for critical damping. (GRAF)

**Darlington Amplifier**–A transistor circuit which, in its original form, consists of two transistors in which the collectors are tied together and the emitter of the first transistor is directly coupled to the base of the second transistor. Therefore, the emitter current of the first transistor equals the base current of the second transistor. This connection of two transistors can be regarded as a compound transistor with three terminals. (GRAF)

**Darlington Pair**–See Darlington Amplifier.

**D'Arsonval Current**–A high-frequency, low voltage current of comparatively high amperage. (GRAF)

**Decibel**–One-tenth of a bel, the number of decibels denoting the ratio of the two amounts of power being ten times the logarithm to the base 10 of this ratio. Note: The abbreviation dB is commonly used for the term decibel. With $P_1$ and $P_2$ designating two amounts of power and n the number of decibels denoting their ratio.

$$n = 10 \log_{10} [P_1 / P_2] \text{ decibel.}$$

When the conditions are such that ratios of currents or ratios of voltages (or analogous quantities in other field) are the square roots of the corresponding powers ratios, the number of decibels by which the corresponding powers differ is expressed by the following equations:

$$n = 20 \log_{10} [I_1 / I_2] \text{ decibel}$$

$$n = 20 \log_{10} [V_1 / V_2] \text{ decibel}$$

where $I_1 / I_2$ and $V_1 / V_2$ are the given current and voltage ratios, respectively. By extension, these relations between numbers of decibels and ratios of currents or voltages are sometimes applied where these ratios are not the square roots of the corresponding power ratios; to avoid confusion, such usage should be accompanied by a specific statement of this application. Such extensions of the term described should preferably be avoided. (IEEE)

**Delay**–The amount of time by which an event is retarded. (2) The amount of time by which a signal is delayed. Note: it may be expressed in time (milliseconds, microseconds, etc.) or in number of characters (pulse times, word times, major cycles, minor cycles, etc.). (IEEE)

**Delay Line**–(electronic computers) (1) Originally, a device utilizing wave propagation for producing a time delay of a signal. (2) Commonly, any real or artificial transmission line or equivalent device designed to introduce delay. (IEEE)

**Depletion Layer**–In a semi-conductor, the region in which the mobile-carrier charge density is insufficient to neutralize the net fixed charge density of donors and acceptors. (GRAF)

**Dielectric Constant**–The property that determines the electrostatic energy stored per unit volume for unit potential gradient. Note: This numerical value usually is given relative to a vacuum. (IEEE)

**Dielectric Strength**–(material) (electric strength) (breakdown strength). The potential gradient at which electric failure or breakdown occurs. To obtain the true dielectric strength the actual maximum gradient must be considered, or the test piece and electrodes must be designed so that uniform gradient is obtained. The value obtained for the dielectric strength in practical tests will usually depend on the thickness of the material and on the method and conditions of test. (IEEE)

**Digital Computer**–A computer that processes information in numerical form. Electronic digital computers generally use binary or decimal notation and process information by repeated high speed use of the fundamental arithmetic processes of addition, subtraction, multiplication, and division.

**Digital-to-Analog (D/A) Converter**–A device which transforms digital data into analog data by translating digital magnitude to equivalent voltage level.

**Diode**–(electronic tube) A two electrode electron tube containing an anode and a cathode.
(semi-conductor) A semi-conductor device having two terminals and exhibiting a non-linear voltage-current characteristic; in more restricted usage; a semi-conductor device that has the asymmetrical voltage-current characteristic exemplified by a single p-n junction. (IEEE)

**Diode Transistor Logic**–Abbreviated DTL. A logic circuit that uses diodes at the input to perform the electronic logic function that activates the circuit transistor output. In monolithic circuits, the DTL diodes are a positive level logic and function or a negative level or function. The output transistor acts as an inverter to result in the circuit becoming a positive NAND or a negative NOR function. (GRAF)

**Dip**–Abbreviation for dual in-line package. (GRAF)

**Dipole Antenna**–Any one of a class of antennas producing the radiation pattern approximating that of an elementary electronic dipole. Note: Common usage considers a dipole to be a metal radiating structure that supports a line current distribution similar to that of a thin straight wire, a half wavelength long, so energized that the current has two nodes, one at each of the far ends. (IEEE)

**Drain (D)**–In a field effect transistor, the element that corresponds to the collector of a transistor. (GRAF)

**Drift**–An undesired change in output over a period of time, which change is not a function of the input.

**Duty Cycle**–The ratio of the time "On" of a device or system divided by the total cycle time (i.e., "On" plus time "Off").
For a device that normally runs intermittently rather than continuously: the amount of time a device operates as opposed to its idle time.

**Electromagnetic Compatability (EMC)**–The ability of electronic communications equipment, sub-systems, and systems to operate in their intended environments without suffering or causing unacceptable degradation of performance as a result of unintentional electromagnetic radiation or response. (GRAF)

**Electromagnetic Interference (EMI)**–Electromagnetic phenomena which, either directly or indirectly, can contribute to the degradation in performance of an electronic receiver or system. (GRAF)

**Electron**–One of the natural elementary constituents of matter. It carries a negative electric charge of one electronic unit. (GRAF)

**Electromotive Force (emf)**–The force which may cause current to flow when there is a difference of potential between two points. (GRAF)

**Electromagnet Waves**–The radiant energy produced by the oscillation of an electric charge. (GRAF)

**Electrolumenescence**–Lumenescence resulting from a high-frequency discharge through a gas or from application of an alternating current to a layer of phosphor. (GRAF)

**Emitter**–A region from which charge carriers that are minority carriers in the base are injected into the base. (IEEE)

**Emitter-Coupled Logic**–Nonsaturated bipolar logic in which the emitters of the input logic transistors are coupled to the emitter of a reference transistor. The basic gate circuit employs a long-tailed pair. Abbreviated ECL. (GRAF)

**Exclusive OR**–A logic operator having the property that if P is a statement and Q is a statement, then P exclusive ORQ is true if either but not both statements are true, false if both are true or both are false. (IEEE)

**Feedback**–The recycling of a portion of the output to the input of a system. Systems employing feedback are called closed-loop systems.

**Feedback Amplifier**–An amplifier that uses a passive network to return a portion of the output signal to modify the performance of the amplifier. (GRAF)

**Ferrites**–Chemical compounds of iron oxide and other metallic oxides combined with ceramic material. They have ferromagnetic properties but are poor conductors of electricity. Hence they are useful where ordinary ferromagnetic materials (which are good electical conductors) would cause too great a loss of electrical energy. (GRAF)

**Ferromagnetic Material**–Material whose relative permeability is greater than unity and depends upon the magnetizing force. A ferromagnetic material

usually has relatively high values of relative permeability and exhibits hysteresis. (IEEE)

**FET**–(field-effect transistor) A semi-conductor device in which the resistance between the source and drain terminals depends on a field produced by a voltage applied to the gate terminal. (GRAF)

**Filter**–A selective network of resistors, inductors, or capacitors which offers comparatively little opposition to certain frequencies or to direct current, while blocking or attenuating other frequencies. (GRAF)

**Flat Pack**–A flat, rectangular integrated circuit or hybrid-circuit package with coplanar leads. (GRAF)

**Flux (Magnetic)**–The sum of all the lines of force in a magnetic field crossing a unit area per unit time.

**Flux Density**–Flux per unit area perpendicular to the direction of the flux. (GRAF)

**Forward Voltage**–($V_F$) The voltage across a semi-conductor diode associated with the flow of forward current. The P – region is at a positive potential with respect to the n – region.

**Frequency Modulated Output**–fm (frequency modulation)–A scheme for modulating a carrier frequency in which the amplitude remains constant but the carrier frequency is displaced in frequency proportionally to the amplitude of the modulating signal. A frequency modulation broadcast system is practically immune to atmospheric and manmade interference.

**Frequency Response**–A measure of how the gain or loss of a circuit, device or system varies with the frequencies applied to it. Also, the portion of the frequency spectrum which can be sensed by a device within specified limits of error.

**Gain**–Any increase in power when a signal is transmitted from one point to another. Usually expressed in decibels. (GRAF)

**GCS**–Abbreviation for gate controlled switch. (GRAF)

**Gate**–(1) A device or element that, depending upon one or more specified inputs, has the ability to permit or inhibit the passage of a signal. (2) (electronic computers) (a) A device having one output channel and one or more input channels, such that the output channel state is completely determined by the contemporaneous input channel states, except during switching transients. (b) A combinational logic element having at least one input channel. (c) An AND gate. (d) An OR gate. (3) In a field effect transistor, the electrode that is analogous to the base of a transistor or the grid of a vacuum tube. (GRAF)

**Hall Effect**–The development of a transverse electric potential gradient in a current carrying conductor or semi-conductor upon the application of a magnetic field.

**Hardware**–(1) Mechanical, magnetic, electrical, or electronic devices; physical equipment (contrasted with software). (2) Particular circuits of functions built into a system. (IEEE)

**Harmonic Distortion**–The production of harmonic frequencies at the output by the nolinearity of a system when a sinusoidal input is applied. (GRAF)

**Heat Sink**–A mounting base, usually metallic, that disipates, carries away, or radiates into the surrounding atmosphere the heat generated within a semi-conductor device. (GRAF)

**Hertz**–The unit of frequency, one cycle per second. (IEEE)

**High-Threshold Logic**–Abbreviated HTL. Logic with a high noise margin, used primarily in industrial applications. It closely resembles DTL, except that in HTL a reverse-biased emitter junction is used as a threshold element operating as a zener diode. A typical noise margin is 6 volts with a 15-volt supply. (GRAF)

**Hole**–In the electronic valence structure of a semi-conductor, a mobile vacancy which acts like a positive electronic charge with a positive mass. (GRAF)

**Hole Conduction**–The apparent movement of a hole to the more negative terminal in a semi-conductor. Since the hole is positive, this movement is equivalent to a flow of positive charges in that direction.

**Hybrid Circuit**–A circuit which combines the thin-film and semi-conductor technologies. Generally, the passive components are made by thin-film techniques, and the active components by semi-conductor techniques. (GRAF)

**Hysteresis**–The difference between the response of a unit or system to an increasing and a decreasing signal. Hysteretical behavior is characterized by inability to *retrace* exactly on the reverse swing a particular locus of input/output conditions. (GRAF)

**Impedence (Z)**–The total opposition offered by a component or circuit to the flow of alternating or varying current. Impedance is expressed in ohms and is similar to the actual resistance in a direct current circuit. Impedence may be computed as Z = E/I, where E is the applied AC voltage and I is the resulting alternating current flow in the circuit.

**Inductance**–The property of an electric circuit by which a varying current in it produces a varying magnetic field that induces voltage in the same circuit or in a nearby circuit - measured in henrys.

**Inductor**–A device consisting of one or more associated windings, with or without a magnetic core, for introducing inductance into an electric circuit. (IEEE)

**Integrated Circuit**–A combination of interconnected circuit elements inspearably associated on or within a continuous substrate. Note: To further define the nature of an integrated circuit, additional modifiers may be prefixed. Examples are: (1) dielectric-isolated monolithic integrated circuit. (2) beam lead monolithic integrated circuit. (3) silicon-chip tantalum thin-film hybrid integrated circuit. (IEEE)

**Input Impedence**–The impedence a transducer presents to a source. The effective impedence *seen looking into* the input terminals of an amplifier; circuit details, signal level, and frequency must be specified. (GRAF)

**Insulator**–A high resistance device that supports or separates conductors to prevent a flow of current between them or to other objects. (GRAF)

**Inverse Voltage**–The effective voltage across a rectifier during the half-cycle when current does not flow. (GRAF)

**Ion Implantation**–A method of semi-conductor doping in which impurities that have been ionized and accelerated to a high velocity penetrate the semi-conductor surface and become deposited in the interior. (GRAF)

**JFET**–Abbreviation for Junction Field Effect Transistor.

**Jump**–(electronic computation) (1) To (conditionally or unconditionally) cause the next instruction to be obtained from a storage location specified by an address part of the current instruction when otherwise it would be specified by some convention. (2) An instruction that specifies a jump. (IEEE)

**Latch**–A feedback loop used in a symmetrical digital circuit (such as a flip-flop) to retain a state. (GRAF)

**Large-Sale-Integration**–Abbreviated LSI. (1) The simultaneous achievement of large area circuit chips and optimum density of component packaging for the express purpose of cost reduction by maximization of the number of system interconnections made at the chip level. (2) Monolithic digital ICs with a typical complexity of 100 or more gates or gate-equivalent circuits. The number of gates per chip used to define LSI depends on the manufacturer. The term sometimes describes hybrid ICs built with a number of MSI or LSI chips. (GRAF)

**Lead Frame**–A metal frame that holds the leads of a plastic encapsulated package (DIP) in place before encapsulation and is cut away after encapsulation. (GRAF)

**Light-Emitting Diode**–A pn junction that emits light when biased in the forward direction. (GRAF)

**Linearity**–The relationship between two quantities when a change in a second quantity is directly proportionate to a change in the first quantity. Also, deviation from a straight-line response to an input signal. (GRAF)

**Logic**–A mathematical approach to the solution of complex situations by the use of symbols to define basic concepts. In computers and information-processing networks, the systematic method that governs the operations performed on the information, usually with each step influencing the one that follows. (GRAF)

**Magneto Resistive Effect**–The change in the resistance of a conductor or semi-conductor due to the application of a magnetic field.

**Memory**–(electronic computation) See Storage.

**Metalization**–The deposition of a thin-film pattern of a conductive material onto a substrate to provide interconnection of electronic components or to provide conductive pads for interconnections. (GRAF)

**Microcomputer**–A complete system capable of performing minicomputer functions, through a much lower power range. Is a combination of the chip sets; interface I/O along with the auxiliary circuits, power supply, and control console.

**Micron**–A unit of length equal to $10^{-6}$ metre.

**Microprocessor**–The digital processor on a chip which performs arithmetic logic and control logic. It is the basic building block of a microcomputer system.

**Minority Carrier**–The less predominate carrier in a semi-conductor. Electrons are the minority carriers in P-type semi-conductors since there are fewer electrons than holes. Holes are the minority carriers in n-types since they are outnumbered by electrons. (GRAF)

**Monolithic**–An integrated circuit which is built on a single slice of Silicon substrate.

**MOS**–Abbreviation for Metal Oxide Semi-conductor.

**MNOS**–Abbreviation for Metal-Nitride-Oxide Semi-conductor. (GRAF)

**Multiplexing**–The process of combining several measurements for transmission over the same signal path. There are two widely used methods of multiplexing; time division, and frequency division. Time division utilizes the principle of time sharing among measurement channels. Frequency division utilizes the principle of frequency sharing among information channels where the data from each channel are used to modulate sinusoidal signals called subcarriers so that the resultant signal representing each channel contains only frequencies in a restricted narrow frequency range. Multiplex radio transmission, for instance, is the simultaneous transmission of two signals over a common carrier wave. (GRAF)

**NAND Gate**–A combination of a *not* function and an *and* function in a binary circuit that has two or more inputs and one output. (GRAF)

**Negative Feedback**–(degeneration) A process by which a part of the output signal of an amplifying circuit is fed back to the input. (GRAF)

**NMOS (N-Type MOS)**–MOS devices made on P-type Silicon substrates where the active carriers are electrons flowing between N-type source and drain contacts.

**Noise**–Unwanted disturbances superposed on a useful signal that tend to obscure its information content.

**Non-Volatile Memory**–Electronic memory which is not lost during power off conditions.

**NOR Gate**–An *or* gate followed by an inverter to form a binary circuit in which the output is logic zero if any of the inputs is one, and vice versa. (GRAF)

**NPN Transistor**–A transistor with a P-type base and N-type collector and emitter. (GRAF)

**Null**–A condition (typically a condition of balance) which results in a minimum absolute value of output. Often specified as the calibration point when the least error can be tolerated by the associated control system.

**N-Type Material**–A crystal of pure semi-conductor material to which has been added an impurity so that electrons serve as the majority charge carriers. (GRAF)

**Ohm**–The unit of resistance. One ohm is the value of resistance through which a potential of one volt will maintain a current of one ampere. (GRAF)

**Operational Amplifier**–An amplifier that performs various mathematical operations. Also called OP-AMP. (GRAF)

**OR Gate**–A multiple-input gate circuit whose output is energized when any one or more of the inputs is in a prescribed state. Used in digital logic.

**Oscillator**–An electronic device which generates alternating current power at a frequency determined by the values of certain constants in its circuits. (GRAF)

**Parallel Processing**–Pertaining to the simultaneous execution of two or more sequences of instructions by a computer having multiple arithmetic or logic units. (IEEE)

**Permeability**–($\mu$) - the measure of how much better a given material is than air as a path for magnetic lines or force. It is equal to the magnetic induction (B) in gausses, divided by the magnetizing force (H) in oersteds. (GRAF)

**Phase Angle**–(1) *general.* The measure of the progression of a periodic wave in time or space from a chosen instant or position. Notes: (a) The phase angle of a field quantity, or of voltage or current, at a given instant of time at any given plane in a waveguide is [wt – Bz + $\theta$], when the wave has a sinuosoidal time variation. The term waveguide is used here in its most general sense and includes all transmission lines; for example, rectangular waveguide, coaxial line, strip line, etc. The symbol B is the imaginary part of the propagation constant for that waveguide, propagation is in the + z direction, and $\theta$ is the phase angle when z = t = 0. At a reference time t = 0 and at the plane z, the phase angle [-Bz + $\theta$] will be represented by $\phi$. (b) Phase angle is obtained by multiplying the phase by 360 degrees or by 2 $\pi$ radians. (2) *current transformer.* The angle between the current leaving the identified secondary terminal and the current entering the identified primary terminal. Note: This angle is conveniently designated by the Greek letter beta ($\beta$) and is considered positive when the secondary current leads the primary current. (3) *Potential [voltage] transformer.* The angle between the secondary voltage from the identified to the unidentified terminal and the corresponding primary voltage. Note: This angle is conveniently designated by the Greek letter gamma ($\gamma$) and is considered positive when the secondary voltage leads the primary voltage. (4) *(instrument transformer).* Phase displacement, in minutes, between the primary and secondary values. (IEEE)

**Photocell**–*photoelectric cell* (1) A solid-state photosensitive electron device in which use is made of the variation of the current-voltage characteristic as a function of incident radiation. (2) A device exhibiting photovolatic or photoconductive effects. (IEEE)

**Piezoelectric**–The property of certain crystals, which: (1) produce a voltage when subjected to a mechanical stress, (2) undergo mechanical stress when subject to a voltage. (GRAF)

**Plasma**–A gas made up of charged particles. Note: Usually plasmas are neutral, but not necessarily so, as, for example, the space charge in an electron tube. (IEEE)

**PMOS (P-Type MOS)**–MOS devices made on an N-type Silicon substrate where the active carriers are holes flowing between P-type source and drain controls.

**PNP Transistor**–A Transistor consisting of two P-type regions separated by an N-type region. (GRAF)

**PNPN Diode**–A semiconductor device which may be regarded as a two transistor structure with two separate emitters feeding a common collector. (GRAF)

**Potential**–The difference in voltage between two points of a circuit. Frequently one point is assumed to be ground which has zero potential. (GRAF)

**Positive Feedback**–*regeneration.* The process by which the amplification is increased by having part of the power in the output returned to the input in order to reinforce the input power. (GRAF)

**Potting**–An embedding process for parts that are assembled in a container or can into which the insulating material is poured, with the container remaining an integral part as the outer surface of the finished unit. (GRAF)

**P-Type Material**–A semi-conductor material that has been doped with an excess of acceptor impurity atoms, so that free holes are produced in the material. (GRAF)

**PROM**–An acronym for Programmable Read Only Memory. An electronic memory which may be permanent (non-volatile) or semi-permanent (erasable electronically or with ultra-violet light) and therefore able to be reprogrammed one or more times.

**RAM**–An acronym for Random Access Memory. A memory that has stored information immediately available when addressed regardless of the previous memory address location. As the memory words can be selected in any order, there is equal access time to all.

**rfi**–*radio-frequency interference.* Radio frequency energy of sufficient magnitude to have an influence on the operation of other electronic equipment. (GRAF)

**Rectifier**–A device which, by vitrure of its asymmetrical conduction characteristic, converts an alternating current into a unidirectional current. (GRAF)

**Regulated Power Supply**–A unit which maintains a constant output voltage or current for changes in line voltage, output load, ambient temperature or time. (GRAF)

**Regulation**–*overall, power supplies*, The maximum amount that the output will change as a result of the specified change in line voltage, output load, temperature, or time. Note: Line regulation, load regulation, stability, and temperature coefficient are defined and usually specified separately. (IEEE)