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MODERN DICTIONARY of ELECTRONICS

SIXTH EDITION

REVISED AND UPDATED


Rudolf F. Graf

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Preface

We are in the midst of a high-technology explosion. Technological advances in electronics and closely related fields occur at a feverish pace. To keep up with this exciting industry, a truly “modern” dictionary must reflect the ever-expanding vocabulary generated by the science of electronics. It must not only record additions to the language but also define and explain terms with authority in that form of the language which is uniquely suited to its time and place.

Those who work in new areas frequently need a new vocabulary to effectively communicate thoughts and ideas about their field of specialization. Originators of newly coined terms assign their initial meanings, but definitions frequently change with technological advances and through actual use by others.

Every new edition of this dictionary corroborates the impressive growth of the electronics industry. It is a body of data about the language of electronics dedicated to the task of improving comprehension and communication, deriving its authority from the care and completeness with which its content were collected and interpreted. Definitions are written in a clear and simple style that is understandable and yet consistent with the level of complexity of the term being defined. It should come as no surprise that this sixth edition of the *Modern Dictionary of Electronics*—probably the most up-to-date electronics dictionary in the world—contains definitions of approximately 25,000 terms unique to electronics and related fields. This includes 5000 more definitions than were in the fifth edition published in 1977, as many *new* terms as would have *half-filled* the first edition published only 20 years ago. All earlier definitions were reviewed and revised or expanded where necessary, to further enhance the intelligibility of each entry and to ensure meaningful, concise definitions requiring no further interpretation. Illustrations have been updated, modified and augmented to help give clarity to the definitions.

While this work is as up-to-date as possible at the time of publication, the field of electronics is expanding so rapidly that new terms continuously evolve and established terms take on broader or more specialized meanings. The publisher intends to issue revised editions of this dictionary periodically; thus suggestions for new terms and definitions are always welcomed.

circuit a specified number of times, corresponding to the decimal digit which is dialed. This is usually accomplished, as with the ordinary telephone dial, by manual operation of a finger wheel.

dial register—See Standard Register of a Motor Meter.

dial telephone system—Telephone system in which telephone connections between customers are ordinarily established by electronic and mechanical apparatus, controlled by manipulations of dials operated by the calling parties.

dial tone—1. A hum or other tone employed in a dial telephone system to indicate that the line is not busy and that the equipment is ready for dialing. 2. A tone indicating that automatic telephone switching equipment is ready to receive dial signals, tones, or pulses.

dial-up—1. The use of a dial or push-button telephone for initiating a station-to-station call. 2. Two simplex transmission paths between central offices and a full-duplex path in each subscriber loop. 3. Use of a phone to initiate a call.

diamagnetic—1. Term applied to a substance with a negative magnetic susceptibility. 2. Bars of certain elements, such as zinc, copper, lead, and tin, when freely suspended in a magnetic field arrange themselves at right angles to the lines of force of the magnetic field, i.e., they are magnetized in the opposite direction to the magnetizing field. These elements are said to be diamagnetic.

diamagnetic material—1. A material which is less magnetic than air, or in which the intensity of magnetization is negative. There is no known material in which this effect has more than a very feeble intensity. Bismuth is the leading example of materials of this class. 2. A material having a permeability less than that of vacuum: $\mu < 1$ gauss/oersted. For practical evaluation, a nonmagnetic material.

diamagnetism—1. A phenomenon whereby the magnetization induced in certain substances opposes the magnetizing force. 2. The negative susceptibility exhibited by certain substances. The permeability of such substances is less than unity.

diamond antenna—Also called a rhombic antenna. A horizontal antenna having four conductors that form a diamond, or rhombus.

diamond lattice—The crystal structure of germanium and silicon (as well as a diamond).

diamond stylus—A phonograph pickup with a ground diamond as its point.

diapason—The unique fundamental tone color of organ music.

diaphragm—1. A flexible membrane used in various electroacoustic transduc-

ers for producing audio-frequency vibrations when actuated by electric impulses, or electric impulses when actuated by audio-frequency vibrations. 2. In electrolytic cells, a porous or permeable membrane, usually flexible, separating the anode and cathode compartments. 3. In waveguide technique, a thin plate, or plates, placed transversely across the waveguide, not completely closing it, and usually introducing a reactance component. See also Iris. 4. A sensing element consisting of a membrane placed between two volumes. The membrane is deformed by the pressure differential applied across it.

diathermal apparatus—Apparatus for generating heat in body tissue by high frequency electromagnetic radiation.

diathermy—The use of radio-frequency fields to produce deep heating in body tissues. The output of a powerful rf oscillator is applied to a pair of electrodes, known as pads, between which the portion of the body to be treated is placed. The body tissues thus become the dielectric of a capacitor, and dielectric losses cause heating of the tissues.

diathermy interference—A form of television interference caused by diathermy equipment, resulting in a horizontal heringbone pattern across the picture.

diathermy machine—A medical apparatus consisting of an rf oscillator frequently followed by rf amplifier stages, used to generate high-frequency currents that produce heat within some predetermined part of the body for therapeutic purposes.

dibit—A group of two bits. In four-phase modulation, each possible dibit is encoded in the form of one of four unique phase shifts of the carrier. The four possible states for a dibit are 00, 01, 10, and 11.

DIC—Dielectrically isolated integrated circuits. Also called DIIC.

dice—The plural of die.

dichroic—Pertaining to the quality of dichroism.

dichroic filter—1. An optical filter capable of transmitting all frequencies above a certain cutoff frequency and reflecting all lower frequencies, thus being either a high-pass or a low-pass filter. 2. A filter used to selectively transmit light according to its wavelength and not its plane of vibration.

dichroic mirror—1. A special mirror through which all light frequencies pass except those for the color which the mirror is designed to reflect. 2. A semitransparent mirror used to selectively reflect light according to its wavelength and not its plane of vibration.

dichroism—1. A property of an optical material which causes light of some wavelengths to be absorbed when the incident

light has its electric-field vector in a particular orientation and not absorbed when the electric-field vector has other orientations. 2. In anisotropic materials, such as some crystals, the selective absorption of light rays vibrating in one particular plane relative to the crystalline axes, but not those vibrating in a plane at right angles thereto. As applied to isotropic materials, this term refers to the selective reflection and transmission of light as a function of wavelength regardless of its plane of vibration. The color of such materials, as seen by transmitted light, varies with the thickness of material examined. Also called dichromatism or polychromatism.

dichromatism—See Dichroism.

dicing—The process of sawing a crystal wafer into blanks.

dictionary—In digital computer operations, a list of mnemonic code names together with the addresses and/or data to which they refer.

diddle—Automatic transmission of letter or figure characters by the terminal unit if no characters are ready for transmission (most often used with a fifo memory).

die—1. Sometimes called chip. A tiny piece of semiconductor material, broken from a semiconductor slice, on which one or more active electronic components are formed. (Plural: dice.) 2. A portion of a wafer bearing an individual circuit or device cut or broken from a wafer containing an array of such circuits or devices. 3. An uncased discrete or integrated device obtained from a semiconductor wafer. See chip. 4. A single miniature active or passive component. So named because the circuits are batch-fabricated by diffusion processes on a silicon wafer, which is then cut into individual components. Examples: transistors, diodes, integrated circuits, diffused resistors.

die-attach—The operation of mounting chips to a substrate. Methods include gold-silicon eutectic bonding, various solders, and conductive (and nonconductive) epoxies.

die bond—1. Attachment of a die or chip to the hybrid substrate. 2. A process in which chips are attached to a substrate (gold, epoxy, wax, etc.). The joint between a die and the substrate.

die bonding—1. The method by which a semiconductor die, or chip, is attached to a mechanical support. 2. Attaching semiconductor chip to the substrate, with an epoxy, eutectic, or solder alloy. 3. The attachment of a die to a gold base such as a substrate pad or to a header. Heat, pressure, and a mechanical scrubbing action are used to create a gold-silicon eutectic bond between the die and base.

dielectric—1. The insulating (nonconducting) medium between the two plates

of a capacitor. Typical dielectrics are air, wax-impregnated paper, plastic, mica, and ceramic. A vacuum is the only perfect dielectric. 2. A medium capable of recovering, as electrical energy, all or part of the energy required to establish an electric field (voltage stress). The field, or voltage stress, is accompanied by displacement or charging currents. 3. The insulating material between the metallic elements of an electromechanical component or any of a wide range of thermoplastics or thermosetting plastics. 4. Any insulating medium which intervenes between two conductors and permits electrostatic attraction and repulsion to take place across it. 5. A material having the property that energy required to establish an electric field is recoverable, in whole or in part, as electric energy. 6. A material medium in which an electric field can exist in the stationary state. 7. Characteristic of materials that are electrical insulators or in which an electric field can be sustained with a minimum dispersion of power. They exhibit nonlinear properties, such as anisotropy of conductivity or polarization, or saturation phenomena.

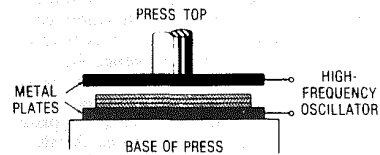
dielectric absorption—1. Also called dielectric hysteresis (short-term effect), or dielectric soak (long-term effect). A characteristic of dielectrics which determines the length of time a capacitor takes to deliver the total amount of its stored energy. It manifests itself as the reappearance of potential on the electrodes after the capacitor has been discharged. Its magnitude depends on the charge and discharge time of the capacitor. 2. That property of an imperfect dielectric as a result of which all electric charges within the body of the material because of the application of an electric field are not returned to the field. 3. Reluctance of a capacitor to give up all the electrons stored when the capacitor is discharged. Primarily caused by a polarization effect of dielectric dipoles and to a lesser extent by free electrons in the dielectric requiring a finite time to move to the electrode. The recovery voltage appearing after discharge divided by the charging voltage and expressed as a percent is called the percent dielectric absorption. 4. The property of a capacitor with slow polarization of its dielectric which results in voltage appearance on the capacitor electrodes after its short-term discharge through a low resistance.

dielectric amplifier—An amplifier employing a device similar to an ordinary capacitor, but with a polycrystalline dielectric which exhibits a ferromagnetic effect.

dielectric analysis—Method of directly monitoring resin cooking, resin staging, and resin curing. Such analysis eliminates

many of the variables influencing the selection of a given set of fabrication conditions. Dielectric analyzers consist of a press with heated platens, a clamshell autoclave, and a DTA/dielectric cell.

dielectric anisotropy—The difference between the dielectric along the director and the dielectric perpendicular to the director of a liquid crystal system.



Dielectric heating.

dielectric antenna—An antenna in which a dielectric is the major component producing the required radiation pattern.

dielectric breakdown—1. An abrupt increase in the flow of electric current through a dielectric material as the applied electric field strength exceeds a critical value. 2. A complete failure of a dielectric material characterized by a disruptive electrical discharge through the material due to a sudden and large increase in voltage.

dielectric breakdown voltage—1. The voltage between two electrodes at which electric breakdown of the specimen occurs under prescribed test conditions. Also called electric breakdown voltage, breakdown voltage, or hi-pot. 2. The voltage at which a dielectric material punctures. 3. The voltage required to cause electrical failure or breakthrough of insulation. Usually expressed as a voltage gradient (volts per mil).

dielectric capacity—The inductivity or specific inductive capacity of a substance, being its ability to convey the influence of an electrified body.

dielectric constant—1. The ratio of the capacitance of a capacitor with the given dielectric to the capacitance of a capacitor having air for its dielectric but otherwise identical. Also called permittivity, specific inductive capacity, or capacitivity. Symbol: K . 2. That property of a dielectric which determines the electrostatic energy stored per unit volume for a unit potential gradient. 3. The property of a material which determines the amount of electrostatic energy that can be stored when a given voltage is applied.

dielectric crystal—A crystal that is characterized by its relatively poor electrical conductance.

dielectric current—The current flowing

at any instant through the surface of an isotropic dielectric which is in a changing electric field.

dielectric dissipation—See Loss Tangent.

dielectric dissipation factor—The cotangent of the dielectric phase angle of a material.

dielectric fatigue—The property of some dielectrics in which the insulating quality decreases after a voltage has been applied for a considerable length of time.

dielectric guide—A waveguide made of a solid dielectric material through which the waves travel.

dielectric heating—A method of raising the temperature of a nominally insulating material by sandwiching it between two plates to which an rf voltage is applied. The material acts as a dielectric, and its internal losses cause it to heat up.

dielectric hysteresis—1. Short-term effect of dielectric absorption. 2. A lagging of an electric field in a dielectric behind the alternating voltage which produces it. It causes a loss similar to that of magnetic hysteresis. 3. See also Dielectric Absorption.

dielectric isolation—1. The electrical isolation of monolithic integrated circuit elements from each other by dielectric material rather than by reverse-biased pn junctions. 2. The use of silicon dioxide barriers created during silicon IC processing to provide isolation between components on a chip.

dielectric lens—A lens used with microwave antennas; it is made of dielectric material so that it refracts radio waves similar to the way an optical lens refracts light waves.

dielectric loss—1. The power dissipated by a dielectric as the friction of its molecules opposes the molecular motion produced by an alternating electric field. 2. The time rate at which electric energy is transformed into heat in a dielectric when it is subjected to a changing electric field.

dielectric loss angle—The complement of the dielectric phase angle (i.e., the dielectric phase angle minus 90°). Also called dielectric phase difference.

dielectric loss factor—The product of the dielectric constant of a material times the tangent of the dielectric loss angle. Also called dielectric loss index.

dielectric loss index—The product of a medium's relative permittivity and the tangent of its dielectric loss angle. See Dielectric Loss Factor.

dielectric matching plate—In waveguide technique, a dielectric plate used as an impedance transformer for matching purposes.

dielectric mirror—A highly frequency-selective, multilayer dielectric reflector acting by partial reflection of light at the

interface between materials of unequal refractive indices.

dielectric phase angle—The angular difference in phase between the sinusoidal alternating voltage applied to a dielectric and the component of the resultant alternating current having the same period.

dielectric phase difference—See Dielectric Loss Angle.

dielectric polarization—See Polarization, 3.

dielectric power factor—The cosine of the dielectric phase angle, or sine of the dielectric loss angle.

dielectric process—Also called electrographic process. A nonimpact printing technique specially treated paper consisting of a conductive base layer coated with a nonconductive thermoplastic material is used to hold an electric charge applied directly by a set of electrode styli. The electric charge corresponds to the latent image of the original. After charging, the image is produced by a toner system similar to that used in electrostatic copying devices. The dielectric process employed on general purpose nonimpact printers, facsimile devices, and some photocopiers.

dielectric rating—Standard test voltages and frequencies above which failure occurs between specified points in a relay structure.

dielectric-rod antenna—An antenna in which propagation of a surface wave on a tapered dielectric rod produces an end-fire radiation pattern.

dielectric soak—Long-term effect of dielectric absorption (which see).

dielectric strength—1. The maximum voltage a dielectric can withstand without rupturing. Also called: electric strength, breakdown strength, electric field strength, and insulating strength. 2. Maximum potential gradient that a dielectric can withstand before it ruptures or a conducting path forms through it. Normally expressed as the ratio of breakdown voltage to the dielectric thickness (volts per mil). 3. The property of a dielectric to withstand an electrical stress. 4. The ratio of dielectric breakdown to the thickness of the insulating materials. 5. The ultimate breakdown voltage of the dielectric or insulation of the resistor when the voltage is applied between the case and all terminals tied together. Dielectric strength is usually specified at sea level and simulated high-altitude air pressures.

dielectric susceptibility—The ratio of the polarization in a dielectric to the electric intensity responsible for it.

dielectric tests—1. Tests which consist of the application of a voltage higher than the rated voltage for a specified time for the purpose of determining the adequacy against breakdown of insulating materials and spacings under normal conditions. 2.

The testing of insulating materials by the application of a constantly increasing voltage until failure occurs.

dielectric waveguide—A waveguide constructed from a dielectric (nonconductive) substance.

dielectric wedge—A wedge-shaped piece of dielectric material used in one waveguide to match its impedance to that of another waveguide.

dielectric wire—A dielectric waveguide used for short-distance transmission of uhf radio waves between parts of a circuit.

dielectric withstanding voltage—Maximum potential gradient that a dielectric material can withstand without failure.

difference—The signal energy representing the differences in information between the signals in two or more stereo channels. A difference signal is produced when stereo signals differing in electrical polarity or in intensity are mixed together in opposing polarity.

difference amplifier—The basic input stage of most operational amplifiers. An amplifier with an inverting and a noninverting input. The output voltage is a function of the voltage difference between the two inputs. See Differential Amplifier.

difference channel—In a stereophonic sound system, an audio channel that handles the difference between the signals in the left and right channels.

difference detector—A detector circuit in which the output is a function of the difference between the peak or rms amplitudes of the input waveforms.

difference frequency—1. A signal representing, in essence, the difference between the left and right sound channels of a stereophonic sound system. 2. One of the output frequencies of a converter. It is the difference between the two input frequencies.

difference in depth modulation—In directive systems employing overlapping lobes with modulated signals, a ratio obtained by subtracting from the percentage of modulation of the larger signal the percentage of modulation of the smaller signal and dividing by 100.

difference of potential—The voltage or electrical pressure existing between two points. It will result in a flow of electrons whenever a circuit is established between the two points.

difference signal—In a quadraphonic sound system, a signal arrived at by subtracting left or right back-channel signal from its respective front-channel signal. Left-front and left-back signals, if added to left-front minus left-back signals yield a left-front channel; if subtracted, they yield a left-back channel.

differential—1. A planetary gear system which adds or subtracts angular move-