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AWV TRANSISTOR GLOSSARY

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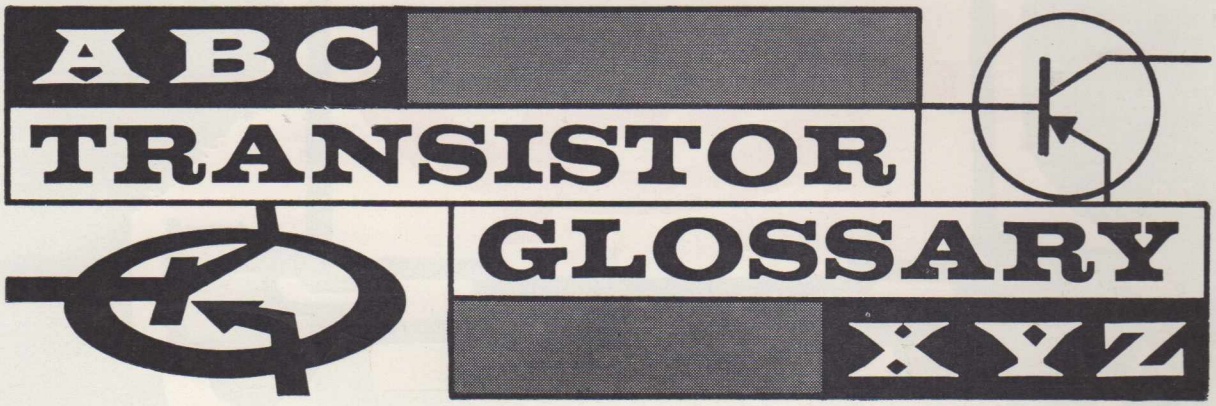

A

Acceptor. Impurity used to produce p-type semiconductor, and induce "hole" conduction.

Alloy-diffused Transistor. Transistor in which the base is diffused in, and the emitter alloyed.

Alloy Process. Process for making junction by fusing an acceptor or donor on the surface of the semiconductor and letting it resolidify.

Alloy Transistor. Transistor made by the alloy process.

Alpha. Emitter-to-collector current gain. For a junction transistor alpha is less than one.

Alpha-cutoff Frequency. The high frequency at which the forward current transfer ratio drops to 0.707 times the value at 1Kc.

Avalanche. The fast progressive build-up of charge carriers in a semiconductor, for example, through the collision of fast-moving carriers with valence electrons in the crystal lattice, thereby giving them enough energy to escape the valence bond and, in turn, liberate further valence electrons.

Avalanche Breakdown. One of the forms of sudden current increase in a reverse-biased p-n junction, caused by an avalanche build-up of carriers as the reverse voltage is increased.

Avalanche Transistor. A switching transistor relying for its conducting state on the condition of avalanche.

B

Back Bias. See Reverse Bias.

Barrier. See Junction.

Barrier Capacitance. See Depletion-layer Capacitance.

Barrier Layer, Barrier Region. See Depletion Layer.

Barrier-layer Capacitance. See Depletion-layer Capacitance.

Base. Transistor electrode consisting of an ohmic or majority carrier contact to the base region.

Base Region. The interelectrode region of a transistor into which minority carriers are injected.

Base Resistance. Resistance in series with the base lead in the common T equivalent circuit of a transistor.

Base Ring. Ohmic contact to the base region of power transistors, made in the shape of a ring.

Beta. Base-to-collector current gain of a transistor.

Bias. The quiescent direct emitter current or collector voltage.

Bottoming. The condition in a transistor where the collector current has become so large that the voltage drop across the load has reduced the collector voltage to a value where it can collect no further increase in current.

Boundary, p-n. See p-n Junction.

Breakdown Voltage. The reverse voltage at which a junction draws a large current.

C

Carrier. A mobile conduction electron or hole.

Class A Amplifier. An amplifier in which the bias of the input electrode and the alternating input signal are such that output current flows at all times.

Collector. Transistor electrode, through which a flow of minority carriers leaves the interelectrode region.

Collector Capacitance. Depletion-layer capacitance associated with the collector junction.

Collector Efficiency. Ratio of useful power output to final stage power supply power input, usually expressed in percentage.

Collector Family. Set of characteristic curves for a transistor in which collector current is plotted against collector voltage for a set of fixed input conditions, e.g., tor a number of fixed emitter currents.

Collector Junction. On junction transistors, the junction between the collector and the base.

Collector Resistance. Resistance in series with the collector lead in the common-T equivalent circuit of a transistor.

Collector Transition Capacitance. See Collector Capacitance.

Common Base. Amplifier configuration, in which the base is common to both input and output circuits.

Common Collector. Amplifier configuration, in which the collector is common to both input and output circuits.

Common Emitter. Amplifier configuration, in which the emitter is common to both input and output circuits.

Complementary Symmetry. Any of several types circuits using both p-n-p and n-p-n transistors in a symmetrical arrangement.

Conduction Band. A range of states in the energy spectrum of a solid in which electrons can move freely.

Conductivity. The characteristic of a material expressing how easily current may flow through it under the action of a voltage gradient. In a semiconductor it is a function of the number of free carriers and their mobility.

Conductivity Modulation (of a semiconductor). The variation of the conductivity of a semiconductor by variation of the charge carrier density.

Configuration. Type of amplifier circuit, depending on which electrode is common to input and output; for example, common-emitter configuration.

Coupling. Method of passing the signal from one stage to another; for example, capacitor coupling, transformer coupling.

Crossover Distortion. Distortion caused in Class-B amplifiers through the increase in input resistance at low emitter currents. Can be reduced by increasing quiescent emitter current, i.e., idling current.

Crystal. Regular array of atoms in a solid; for example, single-crystal germanium.

Current Amplification, Current Gain. Ratio of output to input currents, current flowing into the transistor being considered positive and current flowing out of the transistor being considered negative.

Current Transfer Ratio. See large-signal and small-signal current transfer ratio.

Cutoff Current. Collector (emitter) current with emitter (collector) reverse biased or open circuited, at a specified collector-to-base (emitter-to-base) reverse voltage.

Czochralski Technique. Method of growing large single crystals by pulling them from a molten state. Also known as "crystal pulling".

D

Depletion Layer. Region straddling a p-n junction where the mobile carrier charge density is insufficient to neutralize the net fixed donor and acceptor charge densities. The depletion layer is a region of high voltage fields and increases in width with increasing reverse voltage.

Depletion-layer Capacitance. Capacitance of the depletion layer, decreasing as the layer spreads with increased reverse voltage.

Depletion-layer Transistor. Any of several types of transistors which rely directly on motion of carriers through depletion layers of their operation; for example, spacistor.

Derating. Reducing ratings on a transistor, especially the maximum power dissipation rating at higher temperatures.

Diamond Lattice. The crystal structure of both germanium and silicon as well as diamond.

Diffused-base Transistor. Any of several types of drift transistor in which the grading of impurity concentration in the base region is obtained by diffusing an impurity at high temperature.

Diffused Emitter-collector Transistor. Transistor in which both the emitter and collector are made by the diffusion process.

Diffusion. Particle movement due to spatial variation in concentration of the particles, i.e., due to concentration gradients.

Diffusion Process. Method of making junctions by diffusing acceptors or donors into a semiconductor at a high temperature.

Diffusion Transistor. Transistor relying on diffusion for carrying current; for example, ordinary junction transistor.

Diode. Two-terminal semiconductor device with a rectification current characteristic.

Dissipation. Loss of electrical energy into heat.

Donor. Impurity used to produce n-type semiconductor, and induce electronic conduction.

Doping. Adding impurities to change the resistivity of semiconductors and to make n-type or p-type.

Double-base Diode. See Unijunction Transistor.

Drain. Electrode of a field-effect transistor.

Drift. Movement of charged particles due to spatial variation in voltage, i.e., due to voltage gradients.

Drift Mobility (in a Homogeneous Semiconductor). The average drift velocity of carriers per unit electric field.

Drift Transistor. Transistor utilising grading of impurity concentrations in the base region to provide space charge voltage gradients to impart accelerating drift movement to current carriers.

E

Early Effect. The decrease in collector resistance due to the widening of the collector depletion layer with increasing voltage.

Electroforming. Process of creating p-n junctions by passing current through point contacts.

Electrons. Negatively charged current carriers.

Emitter. Transistor electrode, from which a flow of minority or majority carriers enters the interelectrode region.

Emitter Efficiency. The ratio of minority carriers to total carriers in the emitter current injected into the base region.

Emitter Junction. On junction transistors, the junction between the emitter and the base.

Emitter Resistance. Resistance in series with the emitter lead in the common-T equivalent circuit of a transistor.

Energy Gap. The energy range between the bottom of the conduction band and the top of the valence band. This gap governs the temperature at which thermally-produced charge carriers will swamp the charge carriers introduced by means of donor or acceptor impurities, and thus decides the maximum temperature at which a p-n junction can be used.

Equivalent Circuit. A circuit which approximates the actual transistor under some conditions.

Extrinsic Base Resistance. Resistance between the active base region and the external base connection to the transistor. Generally represented by the symbol r_{bb1}.

Extrinsic Semiconductor. One in which the electrical properties depend on impurities.

F

Field-effect Transistor. Transistor relying on movement of a depletion layer to vary the cross-sectional area of the conduction path between two electrodes, source and drain.

Fieldistor. Type of field-effect transistor.

Figure of Merit. The frequency at which the power gain of the transistor in the common-emitter configuration has dropped to unity.

Floating Junction. Junction through which no net current flows.

Forward Bias. Voltage applied in the direction of easy current flow of a diode; opposite to reverse bias.

Fused-junction Transistor. See Alloy Transistor.

Fused Transistor. See Alloy Transistor.

G

Gate. Electrode of a field-effect transistor.

Germanium. Common semiconductor material, usually used for making transistors.

Grounded Base. See Common Base.

Grounded Collector. See Common Collector.

Grounded Emitter. See Common Emitter.

Grown-diffused Transistor. Junction transistor with junctions formed by diffusion of impurities near a grown junction.

Grown-junction Transistor. Junction Transistor with junctions formed by adding impurities to the melt while the crystal was being grown.

H

Hall Effect. Transverse voltage produced by current travelling at right angles to a magnetic field; especially prominent in semiconductors.

Header. Part of the transistor casing through which the leads pass (in other than large power types).

Heat Sink. Provision for conduction of heat away from power transistors, usually a metal mounting plate.

Hole. A mobile vacancy in the electronic valence structure of a semiconductor that acts like a positive electronic charge.

Hook Transistor. Four layer transistor with a p-n-p (or n-p-n) structure for collector which acts as a current amplifier.

h-parameters. See Hybrid Parameters.

Hybrid π Parameters. A set of 7 frequency-independent parameters which, in a hybrid-π equivalent circuit specify the small signal behaviour of a transistor over its whole useful frequency range.

I

Impurity. Small addition to a semiconductor, especially a donor or an acceptor.

Injector. Electrode of a spacistor.

Interbase Current. In a junction tetrode transistor the current that flows from one base connection to the other through the base region.

Input Resistance. See Small-signal Input Resistance and Large-signal DC Input Resistance.

Intrinsic-region Transistor. Four-layer transistor with an intrinsic region between the base and the collector.

Intrinsic Semiconductor. Neither n-type nor p-type, containing roughly equal numbers of electrons and holes.

i-type. Intrinsic semiconductor. A semiconductor in which the electrical properties are essentially not modified by impurities or imperfections in the crystal.

J

Junction. Region separating two different types of semiconductor, especially p-n junction.

Junction Diode. A diode which uses a junction to achieve a rectifying characteristic.

Junction Transistor. Most common type of transistor, using two junctions with the base region between them.

L

Large-signal Analysis. Consideration of large excursions from the no-signal bias, so that the nonlinear, switching properties of the transistor are important.

Large-signal DC Current Transfer Ratio. The quotient of the dc output current at constant output voltage divided by the dc input current producing the dc output current.

Large-signal DC Input Resistance. The dc input voltage divided by the dc input current.

Leakage Current. That portion of cutoff current due to surface effects.

M

Majority Carriers. Whichever type is more plentiful, i.e., electrons in n-type and holes in p-type.

Meltback Process. Method of making junctions by melting a correctly doped semiconductor and allowing it to refreeze.

Meltback Transistor. Junction transistor made by the meltback process.

Melt-quench Transistor. Junction transistor made by quickly cooling a melted-back region.

Microalloy Transistor. Transistor using very thin alloyed collector and emitter, usually made in the same shape as a surface-barrier transistor.

Minority Carriers. Whichever type is less plentiful, i.e., electrons in p-type and holes in n-type.

Mobility. The average drift velocity of carriers per unit electric field.

Modulator. Electrode of a spacistor.

N

Neutralisation. The process of balancing out an undesirable effect, such as regeneration.

Noise Figure. The ratio of actual equivalent noise input to thermal noise input, usually expressed in decibels.

n-p-i-n Transistor. Intrinsic-region transistor with p-type base and n-type emitter and collector.

n-p-n-p Transistor. Hook transistor with p-type base, n-type emitter, and hook collector.

n-p-n Transistor. Junction transistor with p-type base and n-type collector and emitter.

n-type. Semiconductor doped with a donor so that electrons are more plentiful than holes.

O

Ohmic Contact. A contact possessing the property that the potential difference across it is proportional to the current through it.

P

Parameters. Set of numbers which characterize a device.

Peak Inverse Voltage. Maximum reverse voltage rating for a diode or a transistor.

Photodiode. A semiconductor diode which utilises the fact that the reverse current across a p-n junction increases upon illumination.

Photoresistor. Semiconductor resistor whose resistance drops when illuminated.

Phototransistor. Photodiode with a built-in amplifier; physical construction is the same as a junction transistor.

Photovaristor. A varistor in which the current-voltage relation may be modified by illumination, e.g., cadmium sulphide or lead telluride.

Pinch-off Voltage. The voltage at which pinch-off occurs.

Pinch-off. In a field-effect transistor the effect of having broadened the depletion layer to a point where the source-to-drain current path cross-section has been reduced to zero.

p-n-i-p Transistor. Intrinsic-region transistor with n-type base and p-type emitter and collector.

p-n Junction. Junction between p-type and n-type areas of a semiconductor, at which the donor and acceptor concentration are equal.

p-n-p-n Transistor. Hook transistor with n-type base, p-type emitter, and hook collector.

p-n-p Transistor. Junction transistor with n-type base, and p-type collector and emitter.

Point Contact. A sharp point placed on a semiconductor for making point-contact devices.

Point-contact Diode. A diode which uses a point contact to achieve a rectifying characteristic.

Point-contact Transistor. Early-style transistor made by forming junctions by the unpredictable process of electro-forming.

Power Gain. Ratio of output power to signal input power, not to be confused with collector efficiency.

Power Transistor. A transistor, usually an alloy-junction type, designed to handle high currents and high power.

p-type. Semiconductor doped with an acceptor so holes are more plentiful than electrons.

Punch-through. At a high collector voltage in a junction transistor with a narrow base region, the space-charge layer may extend completely across the base region, causing an emitter/collector breakdown.

R

Rate-grown Transistor. Junction transistors with junctions formed by varying the rate of the crystal's growth.

Recombination. Simultaneous elimination of both an electron and a hole by their combination at the surface of a semiconductor.

Rectifier. Any device which has a non-symmetrical volt-ampere curve and which therefore can be used to rectify ac; for example, junction diodes.

Resistivity. The reciprocal of conductivity.

Reverse Bias. Voltage applied in the direction of difficult current flow of a diode; opposite to forward bias.

Reverse Current. The small current that flows in a diode under reverse bias.

S

Saturation. The low-resistance condition in a transistor when the collector has bottomed.

Saturation Current. That portion of reverse current of a semiconductor diode not due to surface leakage or diode breakdown. Has nothing to do with the saturation of a transistor. Can be taken as the current at a reverse voltage of 0.5 volt.

Saturation Resistance. The ratio of voltage to current in saturation.

Seed. Special single crystal used to start the growth of large single crystals.

Selenium. Semiconductor used mainly in rectifiers.

Semiconductor. An electronic conductor, with resistivity in the range between metals and insulators, in which the electrical charge carrier concentration increases with increasing temperature over some temperature range. Certain semiconductors possess two types of carriers, namely, negative electrons and positive holes.

Silicon. Common semiconductor, used in transistors and diodes.

Small-signal Analysis. Consideration of only small excursions from the no-signal bias, so that the transistor can be represented by a linear equivalent circuit.

Small-signal Current Transfer Ratio. The quotient of the change of output current with ac output shorted divided by the change in input current producing the change in output current. The current components are understood to be small enough for linear relations to hold between them.

Small-signal Input Resistance. The change in input voltage with the ac output circuit shorted, divided by the change in input current.

Source. Electrode of a field-effect transistor.

Space-charge Layer. See Depletion layer.

Spacistor. Type of transistor relying on modulation of carriers injected into a depletion layer.

Stability. Lack of tendency toward thermal runaway.

Stability Factor. A number which expresses the temperature-dependence of collector current (or emitter current) in any given transistor stage. It is the ratio of collector current (or emitter current) variations to collector cutoff current variation for the same collector temperature change. A low figure improves the stability of the stage.

Surface Barrier. A barrier formed automatically at a surface due to trapped electrons held at the surface.

Surface-barrier Transistor. Transistor using surface barriers instead of p-n junctions.

Symmetrical Transistor. Transistor in which collector and emitter are made identical, so either can be used for either purpose.

T

Tandem Transistor. Two transistors in one package, internally connected together.

Tetrode Transistor. Any of several types of transistors with four electrodes.

Thermal Resistance. The resistance to heat flow between a heat-generating device and its environment. Stated as the temperature rise of the device per unit power dissipation.

Thermay Runaway. Condition in which the heat-generation in a device increases with device-temperature faster than does the heat-removal; consequently the device-temperature keeps on rising.

Thermistor. Temperature-sensitive resistor, usually made from a semiconductor.

Transducer Gain. Ratio of power output to signal power available from driving stage or generator.

Transistor. Semiconductor device with three or more electrodes used for amplification.

Transistor Action. The physical mechanism of amplification in a junction transistor.

Transit Time. Average time it takes a minority carrier to move from emitter to collector in a junction transistor.

Transition Layer. See Transition Region.

Transition-layer Capacitance. Capacitance due to the charge distribution in the transition region.

Transition Region. A region between two homogeneous semiconductor regions, in which the impurity concentration changes.

Trapping. Holding of electrons or holes by any of several mechanisms in a crystal, preventing the carriers from moving.

Traps. Any of several imperfections in a crystal which can trap carriers.

Thyristor. Bi-stable, solid state switching element which can also operate as a conventional hf transistor or in amplifying circuits. The bi-stable performance characteristic enables the switching functions which formerly used two transistors.

U

Unijunction Transistor. Transistor made for switching circuits, having only one junction.

Unilateralization. A special case of neutralization in which the feedback parameters are completely balanced out. These feedback parameters include a resistive component in addition to a capacitive component. Unilateralization changes a bilateral network into a unilateral network.

Unipolar Transistor. A transistor in which the main current flow is by means of majority carriers only, e.g., field-effect transistor.

V

Valence Band. The range of energy states in the spectrum of a solid crystal in which lie the energies of the valence electrons that bind the crystal together.

Varistor. A semiconductor device with a symmetrical but nonlinear voltampere characteristic.

Voltage Amplification, Voltage Gain. Ratio of output voltage to input voltage.

W

Whisker. A point contact.

Z

Zener Breakdown. One of the forms of sudden current increase in a reverse-biased p-n junction, due to the liberation of valence electrons through dielectric breakdown of the crystal under high electric field.

Zener Diode. A diode which breaks down at the Zener voltage, used for voltage regulators.

Zener Voltage. The voltage at which Zener breakdown occurs.

Zone Levelling (Pertaining to Semiconductor Processing). The passage of one or more molten zones along a semiconductor body for the purpose of uniformly distributing impurities throughout the material.

Zone Refining. A technique for purifying crystals by passing a melted zone through the crystals, which drags the impurities with it.

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