

Glossary of

Electrotechnical, power, telecommunication, electronics, lighting and colour terms —

Part 1: Terms common to power,
telecommunications and electronics —

Group 05: Semiconductor terminology

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Committees responsible for this British Standard

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- Association of Consulting Engineers
- British Broadcasting Corporation
- Electricity Supply Industry in England and Wales
- Electronic Engineering Association
- Institute of Physics
- Institution of Electrical Engineers
- Ministry of Defence
- Power Generation Association (BEAMA Ltd.)
- Radio and Electronics Technical Press
- Telecommunication Engineering and Manufacturing Association (TEMA)

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Foreword

This Group of Part 1 of this British Standard Glossary, prepared under the direction of the General Electrotechnical Engineering Standards Committee, contains terms and definitions relating to semiconductors. The terms and definitions are technically identical with the corresponding terms appearing in Chapter 521, first edition, of the International Electrotechnical Vocabulary.

This standard revises and supersedes BS 4727-1:Group 05:1972 which is now withdrawn.

BS 4727 combines into one glossary the subjects previously covered by BS 204 “*Glossary of terms used in telecommunication (including radio) and electronics*”, BS 205 “*Glossary of terms used in electrical engineering*”, BS 233 “*Glossary of terms used in illumination and photometry*” and BS 1611 “*Glossary of colour terms used in science and in industry*”. These four glossaries have now been withdrawn.

The glossary is divided into five main Parts, each of which is further subdivided into Groups. Each Group will comprise the terms and definitions used in a particular branch of electrical engineering and will be issued individually as soon as it is completed. This arrangement makes it possible to add new Groups or revise existing Groups at any time without affecting the remainder of the glossary.

The five main Parts of the glossary are as follows.

- *Part 1: Terms common to power, telecommunications and electronics;*
- *Part 2: Terms particular to power engineering;*
- *Part 3: Terms particular to telecommunications and electronics;*
- *Part 4: Terms particular to lighting and colour;*
- *Part 5: Terms particular to electromedical equipment.*

Fundamental and general terms common to power, telecommunications and electronics respectively form the first two Groups of Part 1. General terms particular to Part 2 and Part 3 similarly form the first Groups of their respective Parts. The specialist Groups contain only the terms and definitions relating to their subject.

As far as has been practicable all terms and definitions established in current usage and falling within the scope of this glossary have been included. Experience has shown that it is rarely possible to replace, or even to modify, a well established term no matter what the logical or aesthetic shortcomings of that term may be. Current usage has therefore been accepted as the authority for terms and their meanings except where there has been a very good reason for doing otherwise, e.g. where terms have been considered to be fundamentally wrong, ambiguous, superfluous or in need of standardization. Where two or more synonymous terms are in use, those which are deprecated are omitted from the body of the text but are entered in the alphabetical index with a cross-reference to the standard term. In cases where it was felt that the time was not yet right to deprecate a synonym, preferred terms are given first and other terms are printed in less prominent type to indicate the intention to deprecate them in the course of time. Where synonyms are considered of equal value they are shown in the same type.

Where terms are used with somewhat different meanings in different branches of electrical engineering, appropriate definitions are given in the Groups of the glossary corresponding to these branches. Such a definition, when taken out of the context of its Group, should always be quoted with a preamble indicating its proper context.

It is to be noted that the given definition of a term represents the generally accepted meaning of that term. Under no circumstances should it be regarded as taking the place of a specification.

The numbering system used assigns to each term a Part number (1), a Group number (05), a section number of two digits (01, 02, etc.), and then two digits to give the serial number of the term.

The International Electrotechnical Vocabulary employs a slightly different numbering system and for convenience the IEV number is given in parentheses after the BS number for each term.

A general view of the arrangement of the Group in the glossary can be obtained from the guide to the glossary. An alphabetical index of the terms of the Group is provided at the end to facilitate reference to particular terms. For simplicity, only the last four digits of a term's number are quoted in the index. It is recommended that the user of any Group of the glossary should consider the Group in association with the Groups covering general or fundamental terms within the Part, for Parts 2 and 3, and also together with Groups 01 and 02 of Part 1.

In this glossary parentheses () enclose words or phrases that are not part of the term or definition and can be omitted without affecting the meaning.

Square brackets [] enclose words which may replace a preceding part of an expression.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 22 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Guide to the glossary

Part 1 Terms common to power, telecommunications and electronics

Group 01 Fundamental terminology

Group 02 Electrical and magnetic devices terminology

Group 03 Relay terminology

Group 04 Measurement terminology

Group 05 Semiconductor terminology

Group 06 Electronic tube terminology

Group 07 Magnetism terminology

Group 08 Piezo-electric device terminology

Group 09 Radio interference terminology

Group Integrated electronic circuit terminology^a

Titles to any further groups will be added in due course.

Part 2 Terms particular to power engineering

Group 01 General power terminology

Group 02 Power electronics terminology

Group 03 Rotating machinery terminology

Group 04 Transformer terminology

Group 05 Voltage fluctuation terminology

Group 06 Switchgear and controlgear terminology (including fuse terminology)

Group 07 Tariffs terminology

Group 08 Power cable terminology

Group 09 Transducer terminology

Group 10 Industrial electroheating terminology

Group Systems operation terminology^a

Group Traction terminology^a

Titles to any further groups will be added in due course.

Part 3 Terms particular to telecommunications and electronics

Group 01 General telecommunication and electronics terminology

Group 02 Telephony terminology

Group 03 Telegraphy, including facsimile, terminology

Group 04 Broadcasting, radio and television terminology

Group 05 Propagation and media terminology

Group 06 Radio location and navigation terminology

Group 07 Radiocommunication terminology

Group 08 Electro-acoustics terminology^a

Group 09 Waveguide terminology

Group 10 Recording and reproduction of sound and video terminology

Group 11 Space radiocommunications terminology

Titles to any further groups will be added in due course

Part 4 Terms particular to lighting and colour

Group 01 Radiation and photometry terminology

Group 02 Vision and colour terminology

Group 03 Lighting technology terminology

Titles to any further group will be added in due course

Part 5 Terms particular to electromedical equipment

Group 01 Radiology and radiological physics terminology^a

Titles to any further groups will be added in due course

^a Not yet published, as at September 1985.

105 01 (521-01) Introduction to atomic physics

No.	Term	Definition
105 01 01 (521-01-01)	non-quantized system	<i>Of particles.</i> A system of particles whose energies are assumed to be capable of varying in a continuous manner and in which the number of microscopic states defined by the positions and velocities of the particles at a given instant is therefore unlimited.
105 01 02 (521-01-02)	quantized system	<i>Of particles.</i> A system of particles the energies of which can have discrete values only.
105 01 03 (521-01-03)	Maxwell-Boltzmann statistics	The probability distribution of the macroscopic states of a non-quantized system of particles, defined by the average values of the position, velocity or energy co-ordinates, in a very small, but finite, volume of the system.
105 01 04 (521-01-04)	Boltzmann relation	The equation stating that, apart from an additive constant, the entropy of a system of particles is equal to the product of the Napierian (natural) logarithm of the probability of its macroscopic state and the Boltzmann constant.
105 01 05 (521-01-05)	Maxwell-Boltzmann velocity-distribution law	The algebraic equation giving the number dN of particles of a non-quantized system, the components of velocity of which are comprised in the intervals $(u, u + du)$, $(v, v + dv)$, $(w, w + dw)$ respectively: $dN = A \cdot \exp \left[\frac{-m(u^2 + v^2 + w^2)}{2kT} \right] du \cdot dv \cdot dw$ where: $A = N \left[\frac{m}{(2\pi kT)} \right]^{3/2}$ N is the total number of particles m is the mass of a particle T is the thermodynamic temperature k is the Boltzmann constant NOTE dN/N represents the probability that a particle has its components of velocity within the intervals considered.
105 01 06 (521-01-06)	Bohr atom	The model of the atom based on the conception of Bohr and Sommerfeld, according to which the electrons of an atom move around the nucleus in discrete circular or elliptical orbits. NOTE To each of the degrees of freedom of the atom there corresponds a series of energy states which determine the spectral series that may be emitted by the atom.
105 01 07 (521-01-07)	quantum number	<i>Of an electron in a given atom.</i> Each of the numbers characterizing the degree of freedom of an electron in a given atom: — The principal quantum number n — the orbital quantum number l — the spin quantum number s — the total angular momentum quantum number j

No.	Term	Definition
105 01 08 (521-01-08)	principal quantum number; first quantum number <i>n</i>	The positive integer number characterizing the important changes of energy level of the electrons in an atom. NOTE According to the Bohr atom model, the main quantum number may be considered as characterizing the size of an electron orbit.
105 01 09 (521-01-09)	orbital quantum number; second quantum number <i>l</i>	A quantum number which can have all whole values from zero to $n - 1$, n designating the main quantum number. NOTE According to the Bohr atom model, the orbital quantum number may be considered as characterizing the angular momentum of the electron in its orbital motion round the nucleus.
105 01 10 (521-01-10)	spin (quantum number) <i>s</i>	A quantum number which gives the angular momentum of the electron considered as a small charged sphere revolving around its axis. NOTE The spin may have two values: $+ 1/2$ or $- 1/2$.
105 01 11 (521-01-11)	total angular momentum quantum number <i>j</i>	The quantum number which gives the resultant of the magnetic field engendered by the electron due to its orbital movement and due to its revolving on its own axis. NOTE The values of this number j form a set of integral and semi-integral values.
105 01 12 (521-01-12)	energy-level	<i>Of a particle.</i> The energy associated with a quantum state of a physical system.
105 01 13 (521-01-13)	energy-level diagram	A diagram representing the energy levels of the particles of a quantized system by horizontal lines, having for ordinates the energy of these particles.
105 01 14 (521-01-14)	Pauli-Fermi exclusion principle; Pauli principle	The principle stating that each energy level of a quantized system can include only none, one or two particles. NOTE In the case of two electrons, the spins are of opposite sign.
105 01 15 (521-01-15)	Fermi-Dirac statistics; Fermi statistics	The set of probabilities of the macroscopic states of a quantized system of particles, with only discrete energy levels, obeying the Pauli-Fermi exclusion principle.
105 01 16 (521-01-16)	Fermi-Dirac function	A function expressing the probability $P(E)$, for a particle obeying Fermi statistics, that it will occupy a permitted energy level (E).

$$P(E) = \frac{1}{1 + \exp\left(\frac{E - E_F}{kT}\right)}$$

where:

k is the Boltzmann constant

T is the thermodynamic temperature

E_F is the Fermi-level

and where this level is quantized and may contain 0, 1 or 2 electrons.

In a solid, the energy level separating the occupied states from the unoccupied states at a temperature of zero kelvin.

NOTE When a forbidden band separates the occupied and unoccupied states, the Fermi-level is assigned to the centre of the forbidden band.

105 01 17 (521-01-17) **Fermi-level**

No.	Term	Definition
105 01 18 (521-01-18)	lone electron	An electron which is alone on an energy level.
105 01 19 (521-01-19)	Fermi-Dirac-Sommerfeld velocity distribution law	The algebraic equation giving the number dN of particles of a quantized system in equilibrium, the velocity components of which are included in the intervals $(u, u + du)$, $(v, v + dv)$, $(w, w + dw)$ respectively: $dN = 2N \cdot \frac{m^3}{h^3} \cdot \frac{du \cdot dv \cdot dw}{1 + \exp\left(\frac{E - E_M}{kT}\right)}$ where: N is the total number of particles m is the mass of the particle T is the thermodynamic temperature k is the Boltzmann constant h is the Planck constant E is the kinetic energy of a particle, $E = \frac{m}{2} (u^2 + v^2 + w^2)$ E_M is the inner work function dN/N represents the probability that a particle has its components within the intervals considered.
105 01 20 (521-01-20)	photoelectric effect	An electrical phenomena produced by absorption of photons.
105 01 21 (521-01-21)	photovoltaic effect	A photoelectric effect in which an e.m.f. is produced by the absorption of photons.
105 01 22 (521-01-22)	photoconductive effect	A photoelectric effect characterized by the variation of electric conductivity.
105 01 23 (521-01-23)	photoelectromagnetic effect	In a semiconductor subjected to a magnetic field and electromagnetic radiation, the development of an electric field perpendicular to the magnetic field and to the flow of charge carriers generated by the photoelectric effect and diffusing in the semiconductor.
105 02 (521-02) Properties of semiconductor materials		
105 02 01 (521-02-01)	semiconductor	A substance whose total conductivity due to charge carriers of both signs is normally in the range between that of metals and insulants and in which the charge carrier density can be changed by external means. NOTE The term "semiconductor" generally applies where the charge carriers are electrons or holes.
105 02 02 (521-02-02)	single-element semiconductor	A semiconductor which in the pure state consists of a single element.
105 02 03 (521-02-03)	compound semiconductor	A semiconductor which in the pure state consists of several elements in proportions close to the stoichiometric composition.
105 02 04 (521-02-04)	impurity	1. Foreign atoms in a single-element semiconductor. 2. Foreign atoms or either an excess or a deficiency of atoms with respect to the stoichiometric composition of a compound semiconductor.