
British Standard Guide for
**Graphical symbols for electrical power,
telecommunications and electronics diagrams**
Part 5. Semiconductors and electron tubes

[IEC title: Graphical symbols for diagrams
Part 5: Semiconductors and electron tubes]

Symboles graphiques pour schémas d'électrotechnique, de télécommunications et
d'électronique
Partie 5. Semiconducteurs et tubes électroniques

Schaltzeichen für Diagramme in der Elektrotechnik, Nachrichtentechnik und Elektronik
Teil 5. Halbleiter und Elektronenröhren

National foreword

This Part of BS 3939, prepared under the direction of the General Electrotechnical Engineering Standards Committee, recommends graphical symbols, with definitions, for semiconductors and electron tubes, for use in electrical power, telecommunications and electronics diagrams. It is identical with the English text in IEC Publication 617-5 : 1983 'Graphical symbols for diagrams', Part 5 'Semiconductors and electron tubes', published by the International Electrotechnical Commission (IEC), except that the English text has been rearranged typographically as a consequence of deleting the corresponding French text.

Together with Part 1*, Parts 2 to 4, and Parts 6 to 13, this Part of BS 3939 supersedes the previous edition which is withdrawn in its entirety.

The titles of the other Parts in the BS 3939 series are as follows:

- Part 1 General principles*
- Part 2 Symbol elements, qualifying symbols and other symbols having general application
- Part 3 Conductors and connecting devices
- Part 4 Passive components
- Part 6 Production and conversion of electrical energy
- Part 7 Switchgear, controlgear and protective devices
- Part 8 Measuring instruments, lamps and signalling devices
- Part 9 Telecommunications: switching and peripheral equipment
- Part 10 Telecommunications: transmission
- Part 11 Architectural and topographical installation plans and diagrams
- Part 12 Binary logic elements
- Part 13 Analogue elements

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

To take account of the development of computer draughting, the symbols have been designed to a grid. A transparent over-lay with this grid will be included in Part 1.

Terminology and conventions. The text of the international standard has been approved for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards.

Textual error. When adopting the text of the international standard, the textual error given below was discovered. It has been marked in the text and has been reported to IEC in a proposal to amend the text of the international standard.

In Chapter 1, Section 5, symbol 05-05-05, column headed 'Description', insert 'Unijunction transistor with N-type base'.

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

* In preparation.

Contents

	Page
National foreword	Inside front cover
Committees responsible	Back cover

List of symbols

CHAPTER I: SEMICONDUCTOR DEVICES	2
Section 1 Symbol elements	2
Section 2 Qualifying symbols particular to semiconductor devices	4
Section 3 Examples of semiconductor diodes	4
Section 4 Examples of thyristors	5
Section 5 Examples of transistors	6
Section 6 Examples of photo-sensitive and magnetic field sensitive devices	8
 CHAPTER II: ELECTRON TUBES	 9
Section 7 Symbol elements, general	9
Section 8 Symbol elements mainly applicable to cathode-ray tubes and television camera tubes	10
Section 9 Symbol elements mainly applicable to microwave tubes	11
Section 10 Symbol elements applicable to miscellaneous tubes, including mercury arc rectifiers	13
Section 11 Examples of electronic tubes	14
Section 12 Examples of cathode-ray tubes	15
Section 13 Examples of microwave tubes	16
Section 14 Examples of miscellaneous tubes including mercury arc rectifiers	21
 CHAPTER III: RADIATION DETECTORS AND ELECTROCHEMICAL DEVICES	 23
Section 15 Examples of ionizing radiation detectors	23
Section 16 Electrochemical devices	24

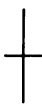
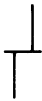
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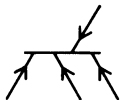
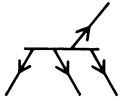
Graphical symbols for electrical power, telecommunications and electronics diagrams

Part 5. Semiconductors and electron tubes

CHAPTER I: SEMICONDUCTOR DEVICES

SECTION 1 – SYMBOL ELEMENTS

No.	Symbol	Description
05-01-01		Semiconductor region with one ohmic connection The horizontal line is the semiconductor region and the vertical line is the ohmic connection
05-01-02	Form 1 	Semiconductor region with several ohmic connections, shown with examples with two ohmic connections
05-01-03	Form 2 	
05-01-04	Form 3 	
05-01-05		Conduction channel for depletion type devices
05-01-06		Conduction channel for enhancement devices
05-01-07	Preferred form 	Rectifying junction
05-01-08	Other form 	
05-01-09		Junction which influences a semiconductor layer by means of an electric field, for example in a junction field effect transistor P-region which influences an N-layer
05-01-10		N-region which influences a P-layer

No.	Symbol	Description
05-01-11		Indication of the conductivity type of the channel for insulated gate field effect transistors (IGFET) N-type channel on P-type substrate, shown for a depletion type IGFET
05-01-12		P-type channel on an N-type substrate, shown for an enhancement type IGFET
05-01-13		Insulated gate <i>Note.</i> – For an example with multiple gates, see symbol 05-05-17.
05-01-14		Emitter on a region of dissimilar conductivity type The slanting line with arrow represents the emitter P emitter on N region
05-01-15		Several P emitters on N region
05-01-16		N emitter on P region
05-01-17		Several N emitters on P region
05-01-18		Collector on a region of dissimilar conductivity type The slanting line represents the collector
05-01-19		Several collectors on a region of dissimilar conductivity type
05-01-20		Transition between regions of dissimilar conductivity types, either P to N, or N to P The short slanting line indicates the point of change along the horizontal line from P to N, or from N to P. No ohmic connection shall be made to the short slanting line
05-01-21		Intrinsic region separating regions of dissimilar conductivity type thus giving either a PIN or NIP structure The intrinsic region lies between the linked slanting lines. Any ohmic connection to the region I shall be made between the short slanting lines and not to them
05-01-22		Intrinsic region between regions of similar conductivity type giving either a PIP or NIN structure

No.	Symbol	Description
05-01-23		Intrinsic region between a collector and a region of dissimilar conductivity type giving either a PIN or NIP structure The connection to the collector is made to the long slanting line
05-01-24		Intrinsic region between a collector and a region of similar conductivity type giving either a PIP or NIN structure The connection to the collector is made to the long slanting line

SECTION 2—QUALIFYING SYMBOLS PARTICULAR TO SEMICONDUCTOR DEVICES

2.1 If necessary, a special function or property essential for circuit operation may be indicated by a qualifying symbol placed adjacent to, or forming part of the symbol of the device.

No.	Symbol	Description
05-02-01		Schottky effect
05-02-02		Tunnel effect
05-02-03		Unidirectional breakdown effect
05-02-04		Bidirectional breakdown effect
05-02-05		Backward effect (unitunnel effect)

SECTION 3 – EXAMPLES OF SEMICONDUCTOR DIODES

No.	Symbol	Description
05-03-01		Semiconductor diode, general symbol
05-03-02		Light emitting diode, general symbol
05-03-03		Diode where use is made of its temperature dependence <i>Note.</i> – θ may be replaced by t° .
05-03-04		Variable capacitance diode (varactor)

No.	Symbol	Description
05-03-05		Tunnel diode
05-03-06		Breakdown diode, unidirectional Voltage regulator diode Esaki-diode
05-03-07		Breakdown diode, bidirectional
05-03-08		Backward diode (unitunnel diode)
05-03-09		Bidirectional diode Diac

SECTION 4 – EXAMPLES OF THYRISTORS

No.	Symbol	Description
05-04-01		Reverse blocking diode thyristor
05-04-02		Reverse conducting diode thyristor
05-04-03		Bidirectional diode thyristor
05-04-04		Triode thyristor, type unspecified <i>Note.</i> – This symbol is used to represent a reverse blocking triode thyristor, if it is not necessary to specify the type of gate.
05-04-05		Reverse blocking triode thyristor, N-gate (anode-side controlled)
05-04-06		Reverse blocking triode thyristor, P-gate (cathode-side controlled)
05-04-07		Turn-off triode thyristor, gate not specified
05-04-08		Turn-off triode thyristor, N-gate (anode-side controlled)
05-04-09		Turn-off triode thyristor, P-gate (cathode-side controlled)

No.	Symbol	Description
05-04-10		Reverse blocking thyristor tetrode type
05-04-11		Bidirectional triode thyristor Triac
05-04-12		Reverse conducting triode thyristor, gate not specified
05-04-13		Reverse conducting triode thyristor, N-gate (anode-side controlled)
05-04-14		Reverse conducting triode thyristor, P-gate (cathode-side controlled)

SECTION 5 – EXAMPLES OF TRANSISTORS

No.	Symbol	Description
05-05-01		PNP transistor
05-05-02		NPN transistor with collector connected to the envelope
05-05-03		NPN avalanche transistor
05-05-04		Unijunction transistor with P-type base
05-05-05		
05-05-06		NPN transistor with transverse biased base

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No.	Symbol	Description
05-05-07		PNIP transistor with ohmic connection to the intrinsic region
05-05-08		PNIN transistor with ohmic connection to the intrinsic region
05-05-09		Junction field effect transistor with N-type channel <i>Note.</i> – The gate and source connections shall be drawn in line.
05-05-10		Junction field effect transistor with P-type channel
05-05-11		Insulated gate field effect transistor (abridged IGFET) enhancement type, single gate, P-type channel without substrate connection <i>Note.</i> – For an example with multiple gates, see symbol 05-05-17.
05-05-12		IGFET enhancement type, single gate, N-type channel without substrate connection
05-05-13		IGFET enhancement type, single gate, P-type channel with substrate connection brought out
05-05-14		IGFET enhancement type, single gate, N-type channel with substrate internally connected to source
05-05-15		IGFET, depletion type, single gate, N-type channel without substrate connection
05-05-16		IGFET, depletion type, single gate, P-type channel without substrate connection