IEC 60747-7

Edition 3.1 2019-09
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Semiconductor devices – Discrete devices – Part 7: Bipolar transistors

Dispositifs à semiconducteurs – Dispositifs discrets – Partie 7: Transistors bipolaires

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IEC 60747-7:2010-12+AMD1:2019-09 CSV(en-fr)

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SEMICONDUCTOR DEVICES –
DISCRETE DEVICES –

Part 7: Bipolar transistors

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IEC 60747-7 edition 3.1 contains the third edition (2010-12) [documents 47E/404/FDIS and 47E/408/RVD] and its amendment 1 (2019-09) [documents 47E/635/CDV and 47E/672/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60747-7 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices.

The main changes with respect to previous edition are listed below.

a) Clause 1 was amended by adding an item that should be included.
b) Clauses 3, 4, 5, 6 and 7 were amended by adding terms, definitions, suitable additions and deletions those should be included.
c) The text of the second edition was combined with that of IEC 60747-7-5.

This standard is to be read in conjunction with IEC 60747-1:2006.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 60747 series, under the general title *Semiconductor devices – Discrete devices*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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SEMICONDUCTOR DEVICES – DISCRETE DEVICES –

Part 7: Bipolar transistors

1 Scope

This part of IEC 60747-7 gives the requirements applicable to the following sub-categories of bipolar transistors excluding microwave transistors.

– Small signal transistors (excluding switching and microwave applications);
– Linear power transistors (excluding switching, high-frequency, and microwave applications);
– High-frequency power transistors for amplifier and oscillator applications;
– Switching transistors for high speed switching and power switching applications;
– Resistor biased transistors.

2 Normative references

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IEC 60050-521:2002, *International Electrotechnical Vocabulary – Part 521: Semiconductor devices and integrated circuits*

IEC 60747-7:2010
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IEC 60747-1:2006, *Semiconductor devices – Part 1: General*

IEC 60747-4:2007, *Semiconductor devices – Discrete devices – Part 4: Microwave diodes and transistors*

3 Terms and definitions

For the purposes of this document the following terms and definitions apply.

3.1 Specific functional regions

3.1.1
functional collector region
collection region that acquires principal-current charge carriers from the functional base region through the (collecting) junction between it and the functional base region

~~NOTE~~ Note 1 to entry In the normal operating mode, this functional region is located in the collector region and, in the inverse operating mode, in the emitter region.

3.1.2
functional emitter region
supply region that delivers principal-current charge carriers into the functional base region through the (emitting) junction between it and the functional base region.

~~NOTE~~ Note 1 to entry In the normal operating mode, this functional region is located in the emitter region and, in the inverse operating mode, in the collector region.

3.1.3
functional base region
control region through which the principal current passes and in which the concentration of principal-current charge carriers is the result of an applied base current

3.1.4
collector(-base) space-charge region;
collector(-base) depletion layer
space-charge region between the functional collector region and the functional base region

3.1.5
emitter(-base) space-charge region;
emitter(-base) depletion layer
space-charge region between the functional emitter region and the functional base region

3.2 Resistor biased transistor

3.2.1

general description
bipolar junction transistors that incorporate with two bias resistors. One bias resistor is connected between the In terminal and the base region and the another between the base region and the common terminal. The resistor biased transistor is specified as a logic circuit element.

The graphical symbol as shown in Figure 1 is used in this standard for resistor biased transistors npn or pnp.

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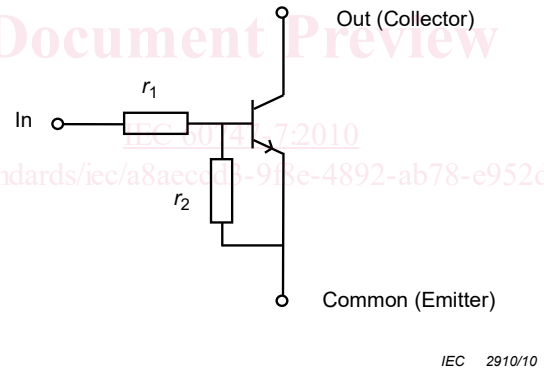

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Figure 1 – Resistor biased transistor graphical symbol

3.2.2
input terminal
terminal connected to the bias resistor 1

3.2.3
output terminal
terminal connected to a collector

3.2.4
common terminal
terminal connected to an emitter

3.2.5
bias resistor 1
resistor connected between the input terminal and the internal base of the transistor

3.2.6
bias resistor 2
resistor connected between the internal base of the transistor and the common terminal

3.3 Terms related to ratings and characteristics

3.3.1
punch-through voltage
value of the collector-base voltage above which the open-circuit emitter-base voltage increases almost linearly with increasing collector-base voltage

~~NOTE~~ Note 1 to entry At this voltage, the collector depletion layer extends through the base to the emitter depletion layer.

~~NOTE~~ Note 2 to entry "Reach-through voltage" is a term also in the USA.

3.3.2
saturation voltages

3.3.2.1
collector-emitter saturation voltage
voltage between the collector and emitter electrodes under conditions of base current beyond which the collector current remains essentially constant as the base current increased.

~~NOTE~~ Note 1 to entry This is the voltage between the collector and emitter electrodes when both the base-emitter and base-collector junctions are forward biased.

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3.3.2.2
base-emitter saturation voltage
voltage between the base and emitter electrodes under conditions of emitter current or collector current and base current beyond which the collector current remains essentially constant as the base current increased.

~~NOTE~~ Note 1 to entry This is the voltage between the base and emitter electrodes when both the base-emitter and base-collector junctions are forward biased.

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3.3.3
cut-off current
reverse current
reverse current of the base-collector junction or base-emitter junction.

3.3.4
saturation resistance
resistance between collector and emitter terminals under specified conditions of base current and collector current when the collector current is limited by the external circuit

~~NOTE~~ Note 1 to entry The saturation resistance may be determined either as the ratio of total voltage to total current or as the ratio of differential voltage to differential current; the method of determination should be specified.

3.3.5
emitter depletion layer capacitance
part of the capacitance across an emitter-base junction that is associated with its depletion layer

~~NOTE~~ Note 1 to entry The emitter depletion layer capacitance is a function of the total potential difference across the depletion layer.

3.3.6
collector depletion layer capacitance
part of the capacitance across a collector-base junction that is associated with its depletion layer