

Harmonized system of quality assessment for electronic components — Discrete semiconductor devices — Sectional specification

[IEC title: Semiconductor devices —
Part 11: Sectional specification for discrete devices]

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National foreword

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The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

The UK participation in its preparation was entrusted to Technical Committee EPL/47, Semiconductors.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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dispositifs discrets**

Semiconductor devices

**Part 11:
Sectional specification for discrete
devices**



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1 Scope

This sectional specification applies to discrete semiconductor devices, excluding opto-electronic devices.

2 General

This specification shall be read together with the generic specification to which it refers; it gives details of the Quality Assessment Procedures, the inspection requirements, screening sequences, sampling requirements, test and measurement procedures required for the assessment of semiconductor devices.

2.1 Related documents

IEC Publication 747-10/QC 700000 (1984), *Semiconductor devices — Part 10: Generic Specification for Discrete Devices and Integrated Circuits*.

2.2 Recommended values of temperatures (preferred values)

See IEC Publication 747-1, Chapter VI, Clause 5.

2.3 Recommended values of voltages and currents (preferred values)

See IEC Publication 747-1, Chapter VI, Clause 6.

2.4 Terminal identification

2.4.1 Diodes

The polarity of diodes shall be clearly indicated by one of the following methods:

- 1) The rectifier arrow graphical symbol pointing towards the cathode.
- 2) A colour code as follows:

— Diodes in A20 (IEC 191-2) and smaller outlines:

These diodes shall be marked with a contrasting colour band or dot at the cathode end. Alternatively, when the type is identified by colour bands, the cathode end may be identified by the use of a double-width band for the first digit. If there is a possibility of the colour code at the cathode end of diodes in envelopes smaller than A1B (IEC 191-2) being confused with a type marking, then the latter shall be omitted.

— Diodes in outlines larger than A20:

Red shall be used for the cathode.

2.4.2 Transistors

The terminal identification shall be as given in the detail specification.

2.4.3 Thyristors

The terminals shall be indicated by one of the following methods:

- 1) The thyristor graphic symbol with the arrow directed towards the cathode terminal.
- 2) A colour code as follows:

The cathode terminal(s) is (are) designated with red. When the anode terminal is designated, it shall be blue (or black). When the gate terminal is designated, it shall be white or yellow.

- 3) When the above marking is not technically feasible, the detail specification shall give the terminal identification.

2.5 Colour codes for type designation

2.5.1 For JEDEC type numbers

The following code is applicable to the “number” part of the type designation (the number following 1N) for small-signal diodes and to the possible suffix letter following this number.

The numbering sequence shall be from left to right, the left being indicated by either a wider colour band or placement of the colour group towards the left side of the body.

Two-digit numbers shall be preceded by a zero.

Colour	Digit	Suffix letter
black	0	none
brown	1	A
red	2	B
orange	3	C
yellow	4	D
green	5	E
blue	6	F
purple (violet)	7	G
grey	8	H
white	9	J

2.5.2 For PRO ELECTRON type numbers

The following code is applicable to small-signal diodes:

Prefix		Serial number	Version letter (if any)
Method I 2 broad bands	Method II Body colour	Method I — narrow bands Method II — one broad band followed by narrow band(s)	
AA — brown BA — red Z — white Y — grey X — black W — blue V — green T — yellow S — orange	BAY — grey BAX — black BAW — blue BAV — green BAT — yellow BAS — orange	0 — black 1 — brown 2 — red 3 — orange 4 — yellow 5 — green 6 — blue 7 — violet 8 — grey 9 — white	A — brown B — red C — orange D — yellow E — green F — blue G — violet H — grey J — white
The cathode side is indicated by the broad band(s).			

2.5.3 Any other type numbers

The colour code shall be defined in the detail specification, with the digits 0 to 9 indicated by the same colour as in the above codes.

2.6 Definitions related to manufacturing operations

2.6.1 Production line

A production line is defined as a single set of process operations comprising one or more of the manufacturing phases:

- wafer operation;
- preparation of dice;
- assembly;
- finishing and final electrical measurements;
- screening (if applicable).

NOTE — Quality assessment procedures are not included in the following phases:

— Diffusion

This phase is the set of manufacturing process operations from the primary stage to the last step before separation of dice.

— Preparation of dice

This phase is the set of manufacturing process operations to divide the wafer into dice.

For the purpose of this specification, this phase shall be included either in the diffusion or the assembly phase at the manufacturer's convenience.

— Assembly

This phase is the set of manufacturing process operations comprising die attach, lead bonding and encapsulation.

— Finishing and final electrical measurements 

- A2** This phase is the set of manufacturing process operations before lot release comprising, for example:
- post - treatment of terminals including plating operation, if any;
 - coating;
 - marking;
 - final electrical measurements.
- Screening (if applicable)

This phase may be part of the assembly and/or finishing operation(s).

2.6.2 Production lot

A production lot consists of devices of the same type, manufactured in the same production line, and passing through the same nominated process, normally within one week. **A2**

3 Quality assessment procedures

3.1 Primary stage of manufacture

The primary stage of manufacture for discrete semiconductor devices is the first process that changes the monocrystalline semiconductor material from being entirely P-type or entirely N-type for silicon devices or similar changes for other semiconductor materials.

3.2 Structurally similar devices

For the purpose of obtaining samples both for qualification approval and for lot-by-lot and periodic testing, discrete semiconductor device types may be grouped as described below.

3.2.1 Grouping for electrical tests

Devices having the same design, manufactured on the same production line but differing only by a selection based on electrical characteristic limits or ratings shall be grouped into sub-lots of types according to these different electrical characteristic limits or ratings, that is, divided into types.

Such devices should preferably be included in the same detail specification but in any case the details of the grouping used shall be indicated in the qualification approval test report.

3.2.1.1 Different electrical characteristic limits or ratings

For those particular tests where different electrical characteristic limits or ratings apply for each of the sub-lots, each sub-lot shall be sampled with a sample size appropriate to the number or components in each sub-lot.

Examples of such particular selections are:

- a) the selection of diodes into sub-lots having different voltage ratings;
- b) the selection of transistors into sub-lots having different forward current transfer ratio limits;
- c) the selection of rectifier diodes into sub-lots having different voltage ratings;
- d) the selection of thyristors into sub-lots having different voltage ratings.

3.2.1.2 Identical electrical characteristic limits

For those particular tests where the same electrical characteristic limit and test conditions apply for all the sub-lots, the total lot shall be assessed by testing either:

- a) a single sample of a size appropriate to that of the total lot, comprising equal or proportionate quantities of all the sub-lots, or
- b) a single sample of a size appropriate to that of the total lot, taken at random from the total lot.

An example of such a particular test is the forward voltage drop test for all the reverse voltage rated types of diodes in b) above where the same limit applies to all types.

3.2.2 Grouping for dimensional, climatic and mechanical inspections or tests

Devices that have been encapsulated by the same method, have the same basic type of internal mechanical structure, have used identical piece parts and have been subjected to common finishing and sealing procedure may be considered as structurally similar, as described below, and a single sample of a size appropriate to that of the total lot can be taken to assess the total lot of such similar devices.

NOTE "Identical piece parts" means that the piece parts have been manufactured or procured to the same drawing or specification and have been accepted.

3.2.2.1 Devices made on identical production lines

NOTE "Identical production lines" means lines that have equivalent equipment, have identical process control drawings or specifications, use identical piece parts and materials, are located in the same plant site and are capable of producing identical devices;

The tests to which the above grouping can apply are:

- a) visual examination;
- b) dimensions;