SLOVENSKI STANDARD
SIST EN 153000:2002

01-september-2002

Generic specification: Discrete pressure contact power semiconductor devices (Qualification approval)

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Fachgrundspezifikation: Druckkontakt-Einzel-Leistungshalbleiterbauelemente (Befähigungsanerkennung)

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Ta slovenski standard je istoveten z: EN 153000:1998

ICS:

31.080.01	Polprevodniški elementi (naprave) na splošno	Semiconductor devices in general

SIST EN 153000:2002 **en**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 153000

April 1998

ICS 31.080.00

Descriptors: Quality, electronic components, discrete pressure contact power semiconductors

English version

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Ref. No. EN 153000:1998 E

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Foreword

This European Standard was prepared by CECC Working Group 7 "Rectifier diodes and thyristors". In the absence of a current chairman or secretary of CECC Working Group 7, this specification was submitted to the CECC by the UK ONH under the Single Originator Procedure. It is based whenever possible on the publications of International Electrotechnical Commission (IEC) and in particular on those referred to under "Related Documents".

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 153000 on 1995-11-28.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	1998-11-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	1998-11-01

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1 General

1.1 Scope

This document applies to discrete pressure contact power semiconductor devices namely rectifier diodes, transistors, thyristors and their derivatives. The requirements also cover encapsulated assemblies. The document does not apply to stacks or assemblies made with these encapsulated components.

1.2 Related documents

CECC 00 007	Basic specification: Sampling plans and procedures for inspection attributes
CECC 00 111	RP 11: Specifications
EN 100114-1	Rule of procedure - Quality Assessment Procedures Part 1: CECC requirements for the approval of an organization
EN 100114-2	Part 2: CECC requirements for the qualification approval, the release for delivery and the validity of release of electronic components
IEC 60027	Letters symbols to be used in electrical technology (several parts)
IEC 60050	International Electrotechnical Vocabulary
IEC 60068	Basic environmental testing procedures, namely:
IEC 60068-1	Part 1: General
IEC 60068-2-2	Dry heat: Test Ba
IEC 60068-2-6	Vibration (sinusoidal): Test Fc
IEC 60068-2-14	Change of temperature: Tests Na, Nb and Nc
IEC 60068-2-17	Sealing: Tests Qc, Qk and Q1
IEC 60148	Letter symbols for semiconductor devices and integrated microcircuits
IEC 60191	Mechanical standardization of semiconductor devices (several parts)
IEC 60410	Sampling plans and procedures for inspection of attributes (see also CECC 00 007)
IEC 60617	Graphical symbols for diagrams
IEC 60747-2	Semiconductor devices and integrated circuits Part 2. Rectifier diodes
IEC 60747-6	Semiconductor devices and integrated circuits Part 6. Thyristors

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ISO 497	Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers
ISO 1000	SI units and recommendations for the use of their multiples and of certain other units
ISO/R 2015*	Numbering of weeks

*superseded by ISO 8601: 1988: Data elements and interchange formats - information interchange - Representation of dates and times

1.3 Units, symbols and terminology

Units, graphical symbols, letter symbols and terminology shall, whenever possible, be taken from the following documents:

IEC 60027	Letter symbols to be used in electrical technology
IEC 60050	International electrotechnical vocabulary
IEC 60617	Graphical symbols for diagrams
ISO 1000	SI units and recommendations for the use of their multiples and of certain other units

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Any other units, symbols and terminology peculiar to one of the components covered by a generic specification, shall be taken from the relevant IEC or ISO documents, listed under "Related documents".

1.4 Standard and preferred values

Ratings and characteristics shall be chosen from IEC 60747-2 and IEC 60747-6 at the time of producing the Detail Specification in conjunction with the customer requirements.

1.5 Marking of component and package

The following shall be marked on the device, in the following order of precedence, as space permits. All the information, except the terminal marking, shall appear on the primary pack used as initial protection or wrapping for delivery:

a) Terminal identification	(1.5.1)
b) Type designation	(1.5.2)
c) Date code factory identification code or manufacturer's name or trade-mark	(1.5.4) and/or: (1.5.3)
d) Mark of Conformity unless a Certificate of Conformity is used	

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In addition, the primary pack shall be marked with the detail specification reference, followed by the letter defining the level of quality assessment (annex A) and, if applicable, by the letter identifying the screening sequence (annex C).

Example: EN 153 002-000 F-C.

The detail specification shall prescribe the information actually marked on the device.

1.5.1 *Terminal identification*

The terminals shall be identified in at least one of the following ways:

- in accordance with the specified outline or base drawing;
- in accordance with one of the methods given in 2.5.1.1, 2.5.1.2 or 2.5.1.3;
- as specified in the detail specification.

1.5.1.1 *Diodes*

Polarity of diodes shall be clearly indicated by one or more of the following methods:

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- the rectifier arrow graphical symbol pointing towards the cathode;
- a colour code as follows:

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Red shall be used for the cathode.

Black shall be used for the anode.

1.5.1.2 *Transistors*

When so specified in the detail specification, transistor terminals shall be identified by the following colour code:

Collector terminal	Red
Emitter terminal	Blue
Base terminal	Yellow

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Fourth terminal if present:

- if connected to collector, emitter or base: the relevant colour of this electrode;
- if connected to anything else (for instance a shield): uncoded.

When it is appropriate to identify only one terminal, the collector shall be marked.

1.5.1.3 *Thyristors*

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

- The thyristor graphical symbol with the arrow directed towards the cathode terminal.

- A colour code as follows:

Cathode terminal(s)	Red; and/or
Anode terminal(s)	Blue (or black)
Gate terminal(s)	Yellow (or white).

1.5.2 *Type designation*

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The type designation shall be given in letters and figures.

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1.5.3 *Manufacturer's name or trade-name*

Where the certificate of conformity enables traceability to a manufacturer's factory, the manufacturer's name or trade-name is sufficient. In all other cases, the factory identification code shall be used.

1.5.4 *Date code system*

The date code system is as ISO/R 2015 for the week, preceded by the last two digits of the year (example: 9245 - 45th week of 1992).

1.6 Subcontracting

Subcontracting within the rules of EN 100114-2, subclause 1.2 is not permitted.

1.7 Validity of release

Release is valid for a period of 2 years. See 2.3.5 for the requirements for subsequent delivery.

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2 Quality assessment procedures

2.1 General

The quality assessment tests are subdivided into Group A, Group B tests which are performed on each lot, Group C tests which are performed periodically and Group D tests which are performed for design proving only.

The following CECC ongoing product assessment procedure is designed to produce consistent high reliability power semiconductor devices and enable a manufacturer once approved (see EN 100114-1) to claim "Qualification Approval".

2.1.1 *Manufacturing and system control*

The company shall be audited to ensure that quality and manufacturing control systems are in place, based on EN 100114-1, which incorporates the requirements of EN ISO 9000.

2.1.2 *Primary stage of manufacture*

The primary stage for bipolar semiconductor devices is the first process which changes the monocrystalline semiconductor material from being wholly P-type or wholly N-type.

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2.1.3 *Definition of a production lot*

Unless otherwise stated, a production or inspection lot (hereinafter referred to as "lot") shall consist of devices having structurally similar design, manufactured on the same production line, and normally assembled during a maximum of 6 weeks. (Maximum lot size 500 pieces).

2.1.4 *Structurally similar components*

The crucial criterion for grouping of types of devices as structurally similar is that the differences between the various types have no influence on the results of the test for which the group has been formed. Rotation within the group shall be performed to ensure all types are tested.

2.2 Qualification approval procedures

New product ranges shall be subject to groups A, B, C and D testing prior to approval being given. Approval shall consist of a review of the test data by the Chief Inspector and subsequent authorisation by him of approved status for that product range. Potential customers shall have this information made available to them on request as a Test Report. The Test Report shall consist of a listing of tests performed, conditions of testing, sample sizes and results of individual measurements before and after each test.

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2.3 Quality conformance inspection requirements

Quality conformance inspection shall be based on samples taken from each lot of structurally similar product (see 2.1.4). Where no product has failed assessment, device release to the customer shall be on a continual basis. Where a failure has occurred that is attributed to faulty manufacturing, corrective action shall be taken and a hold put on the product until that or subsequent lots have been proven to meet the full requirements of the subgroup in which the failure occurred. Lots shall continue to be held for that subgroup until 3 batches have passed without failure, when sampling and continual release shall be re-introduced. In the most serious instances of failure, product may be required to be withdrawn from stock and the customer shall be notified accordingly.

2.3.1 *Division into groups and sub-groups*

Group A inspection (production lot)

This group prescribes the visual inspection and the electrical measurements to be made on the lot to assess the principal properties of a device.

Group A inspection is divided into appropriate sub-groups as follows:-

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Sub-group A1:

This sub-group comprises visual inspection, and polarity inspection when specified.

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Sub-group A2:

This sub-group comprises those measurements which are of primary importance for verifying the description of the device.

Sub-group A3/A4:

These sub-groups may not be required. When they are required, they shall comprise those measurements which are of secondary importance for verifying the description of the device.

The choice between sub-groups A3 or A4 for given measurements shall be governed by the desirability to perform them at given sampling requirements, but shall also take into account whether the measurements can be made automatically on a large sample or need to be performed manually, but on a reduced number of specimens.

Sub-group A5:

Mechanical, hermeticity - see clause 3.4.5.

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Group B inspection (production lot)

This group prescribes the procedures to be used on a lot-by-lot basis to assess certain additional properties of the device, and includes mechanical, climatic and electrical endurance tests which can be completed in less than one week.

Group C inspection (periodic)

This group prescribes the procedures to be used on a periodic basis to assess certain additional properties of the device, and includes electrical measurements, mechanical, climatic and endurance tests which are appropriate for checking at periodic intervals, generally three months or longer.

Sample for periodic tests shall be drawn from lots which have been accepted in group A and B tests. Furthermore, the individual specimens shall have passed those group A measurements called for in the failure criteria.

In the event of failure at group C inspection the procedure as defined in 2.3 applies.

Division of group B and group C inspection into sub-groups

For ease of comparison the tests in these groups have been divided among sub-groups which bear the same number for corresponding tests.

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The division is as follows:

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Sub-groups B1/C1:

Comprise those measurements which control the dimensional interchangeability of the device.

Sub-groups B2/C2:

Comprise those measurements which assess the durability of marking.

Sub-groups B3/C3:

Comprise those tests which are intended to assess the mechanical robustness of the terminations of the device (for instance stud torque, lead bending).

Sub-groups B4/C4:

Comprise those tests which are intended to assess the ability of the device to be soldered.

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Sub-groups B5/C5:

Comprise those tests which are intended to assess the ability of the device to withstand climatic stresses (for instance change of temperature).

Sub-groups B6/C6:

Comprise those tests which are intended to assess the ability of the device to withstand mechanical stresses (for instance vibration).

Sub-groups C7:

Comprises those tests which are intended to assess the continuous switching ability of the device (for instance thermal cycling).

Sub-groups B8/C8:

Comprise those tests which are intended to assess the failure characteristics of the device under endurance testing.

Sub-groups B9/C9:

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Comprise those tests which are intended to assess the electrical properties of the device under storage conditions at extremes of temperature.

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Sub-groups B10/C10:

Comprise those tests which are intended to assess the performance of the device during variations of air-pressure, if required.

Sub-groups CTR:

Lists the selection of the tests and/or measurements done in the preceding sub-groups, the results of which are to be presented in the certified test records.

2.3.2 *Inspection requirements*

The tables of annex A summarize the general rules concerning inspection requirements. Nevertheless the relevant blank detail specification shall take precedence, except that a detail specification can still add further tests per sub-group, especially in group A, or add one or more sub-groups.

The LTDP values or alternatively the sample sizes (n) and acceptance criteria (c), given in the tables apply to the whole of each sub-group or section of each sub-group and not to any single test in the sub-group.

When "na" is indicated, this means that the relevant sub-group is not applied.