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Edition 2.0 2006-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Surface mounting technology –
Part 1: Standard method for the specification of surface mounting components (SMDs)

Technique du montage en surface –
Partie 1: Méthode de normalisation pour la spécification des composants montés en surface (CMS)

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SURFACE MOUNTING TECHNOLOGY –

Part 1: Standard method for the specification of surface mounting components (SMDs)

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International Standard IEC 61760-1 has been prepared by IEC technical committee 91: Surface mounting technology.

This second edition cancels and replaces the first edition, published in 1998, and constitutes a technical revision.

The main changes with regard to the previous edition concern:

– requirements related to leadfree soldering;
– extension of the scope to include also components mounted by gluing;
– direct reference to IEC 60068-2-58 for requirements on solderability and resistance to soldering heat;
– classification into categories based on the component's ability to withstand resistance to soldering heat has been deleted.

This bilingual version (2014-02) corresponds to the monolingual English version, published in 2006-04.

The text of this standard is based on the following documents:

FDIS	Report on voting
91/577/FDIS	91/588/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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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- withdrawn;
- replaced by a revised edition, or
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INTRODUCTION

Specifications for electronic components have in the past been formulated for each component family. The regulations for environmental tests have been selected from IEC 60068 and other IEC and ISO publications. The overriding condition for this procedure was that all components, once installed in a piece of equipment, had to satisfy certain criteria.

The introduction and increasing use of surface mounting components make it necessary to extend the existing requirements to include those arising from processing during assembly.

Irrespective of the component family involved, all components on one and the same side of a printed circuit board are exposed to the same mounting process (see flow charts in Clause 5).

Nevertheless there exists no harmonized standard that prescribes the content of a component specification. It is the purpose of this standard to define the general requirements for component specifications derived from the assembly processes. This is done in three steps.

In the first step general requirements for component specifications and component design related to the handling and placement of the component on the substrate are given (Clause 4). In the second step the definition of reference process conditions as representative of a group of assembly conditions are given (Clauses 5 and 6).

In the third step the additional requirements resulting from these reference process conditions are given (Clause 7).

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Mixed technology boards, i.e. boards containing through-hole components and SMDs, require additional consideration with respect to the through-hole components. These may be subject to the same requirements as the SMDs. Persons responsible for drafting specifications for “non-surface mounting components” wishing to include a statement on their ability to withstand surface mounting conditions should use the classifications and tests set out in the present standard.

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SURFACE MOUNTING TECHNOLOGY –

Part 1: Standard method for the specification of surface mounting components (SMDs)

1 Scope and object

1.1 Scope

This International Standard gives a reference set of process conditions and related test conditions to be used when compiling component specifications of electronic components that are intended for usage in surface mount technology.

1.2 Object

The object of this standard is to ensure that a wide variety of SMDs (passive and active) can be subjected to the same placement and mounting processes during assembly. This standard defines tests and requirements that need to be part of any SMD component general, sectional or detail specification. In addition, this standard provides component users and manufacturers with a reference set of typical process conditions used in surface mount technology.

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2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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IEC 60062, *Marking codes for resistors and capacitors*

IEC 60068 (all parts), *Environmental testing*

IEC 60068-2-21, *Environmental testing – Part 2: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-45:1980, *Environmental testing – Part 2: Tests – Test XA and guidance: Immersion in cleaning solvents*
Amendment 1 (1993)

IEC 60068-2-58, *Environmental testing – Part 2: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMDs)*

IEC 60068-2-77, *Environmental testing – Part 2: Tests – Test 77: Body strength and impact shock*

IEC 60191-6:2004, *Mechanical standardization of semiconductor devices – Part 6: General rules for the preparation of outline drawings of surface mounted semiconductor device packages*

IEC 60194, *Printed board design, manufacture and assembly – Terms and definitions*

IEC 60286-3, *Packaging of components for automatic handling – Part 3: Packaging of surface mount components on continuous tapes*

IEC 60286-4, *Packaging of components for automatic handling – Part 4: Stick magazines for electronic components encapsulated in packages of form E and G*

IEC 60286-5, *Packaging of components for automatic handling – Part 5: Matrix trays*

IEC 60286-6, *Packaging of components for automatic handling – Part 6: Bulk case packaging for surface mounting components*

IEC 60749 (all parts), *Semiconductor devices – Mechanical and climatic test methods*

IEC 61340-5-1, *Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements*

IEC 61340-5-3, *Electrostatics – Part 5-3: Protection of electronic devices from electrostatic phenomena – Test methods for packagings intended for electrostatic discharge sensitive devices*

IEC 61760-2, *Surface mount technology – Part 2: Transportation and storage conditions of surface mounting devices (SMD) – Application guide*

IEC 62090, *Product package labels for electronic components using bar code and two dimensional symbologies*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

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3 Terms and definitions

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For the purposes of this document, the following definitions apply, as do those of IEC 60194.

NOTE Use of the term “chip” as for a surface mounting component is deprecated. Only the terms "SMD" or "surface mounting component" should be used within IEC.

3.1
adhesive
substance such as glue or cement used to bond objects together

NOTE In surface mounting technology different gluing systems are used.

– Non conductive adhesive (only for mechanical connection)
– Electrical conductive adhesive (for electrical and mechanical connection)
– Thermal conductive adhesive (for thermal and mechanical connection)
– Combination of electrical and thermal conductive adhesive.

Most used adhesives are thermal curing systems but there are also UV-curing systems in use.

3.2
centring force
force required by the pick-up tooling to centre a surface mounting device in its proper location on a substrate

3.3
coplanarity
distance in height between the lowest and highest leads when the component is in its seating plane

3.4
dewetting
condition that results when molten solder coats a surface and then recedes to leave irregularly-shaped mounds of solder that are separated by areas that are covered with a thin film of solder and with the basis metal not exposed

3.5
dissolution of metallization
process of dissolving metal or a plated metal alloy, usually by introduction of chemicals. For the purpose of this document the dissolution of metallization also includes dissolution by exposure to molten solder

3.6
immersion attitude
positioning of an object when immersed in a solder bath

3.7
lead-free component
component where lead content in the materials is equal or less than 0,1 % by weight per material used

3.8
Montreal protocol
agreement by industrialized nations, at a meeting held in Montreal, Canada, to eliminate chlorofluorocarbons from all processes by 1995

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3.9
pick-up force
dynamic force exerted on the body of a component – generally from above – and its seating plane during the pick-up of the component (e.g. from a tape or tray); the maximum level is normally taken into account

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3.10
placement force
dynamic force exerted on the component body – generally from above – and its seating plane

NOTE This occurs during the period between the component's first contact with the substrate (or the soldering paste or adhesive etc.) and its coming to rest. The maximum level is normally taken into account.

3.11
resistance to soldering heat
ability of a component to withstand the effects of the heat generated by the soldering process

3.12
seating plane
surface on which a component rests

3.13
solderability
ability of a metal to be wetted by molten solder

3.14
solder meniscus
contour of a solder shape that is the result of the surface tension forces that take place during wetting

3.15
stand-off
distance between seating plane of the component and the seating plane of the terminations

3.16
substrate
basic material, forming the support structure of an electronic circuit

3.17
surface mounting component
electronic component designed for mounting on to terminal pads or conducting tracks on the surface of substrate

3.18
wetting
physical phenomenon in which surface tension of a liquid, usually when in contact with solids, is reduced to the point where the liquid diffuses and makes intimate contact with the entire substrate surface in the form of a thin layer

4 Requirements for component design and component specifications

4.1 General requirement

A component specification for SMDs shall, in addition to the requirements listed in 4.2 to 4.10 below, contain specifications of the relevant tests and requirements from Clause 7.

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4.2 Packaging

Information about the packaging form including packaging dimensions and data on clearances within the packaging shall be included in the component specification.

Component specifications shall require that, packaging for SMD applications in tapes, on reels, in stick magazines, on tray, bulk case, or in bulk shall comply with the relevant specification of the IEC 60286 series (IEC 60286-3, IEC 60286-4, IEC 60286-5, IEC 60286-6).

Components that need to be entered into ESD protected production environment shall be packaged accordingly in line with IEC 61340-5-1 and IEC 61340-5-3.

Moisture sensitive components need special packaging in line with IEC 60749.

Components with specific orientation or polarity shall be placed in the packaging with a fixed orientation (e.g. see Figure 1).

4.3 Labelling of product packaging

Labelling of the product packaging shall comply with IEC 62090.

According to IEC 62090 the product packaging shall include the following:

a) item identification (e.g. customer part number or manufacturer part number or both);
b) traceability identification (e.g. batch number or serial number);
c) quantity;

Additional to the requirements of IEC 62090, this standard prescribes that the product packaging for moisture sensitive components shall include the following:

d) moisture sensitivity level (MSL) according to IEC 60749;

Additional to the requirements of IEC 62090, this standard recommends that the product packaging should include the following:

e) date code (ISO 8601, and IEC 60062);

f) identification code for the manufacturer;

g) Description of the polarity of the component, if applicable.

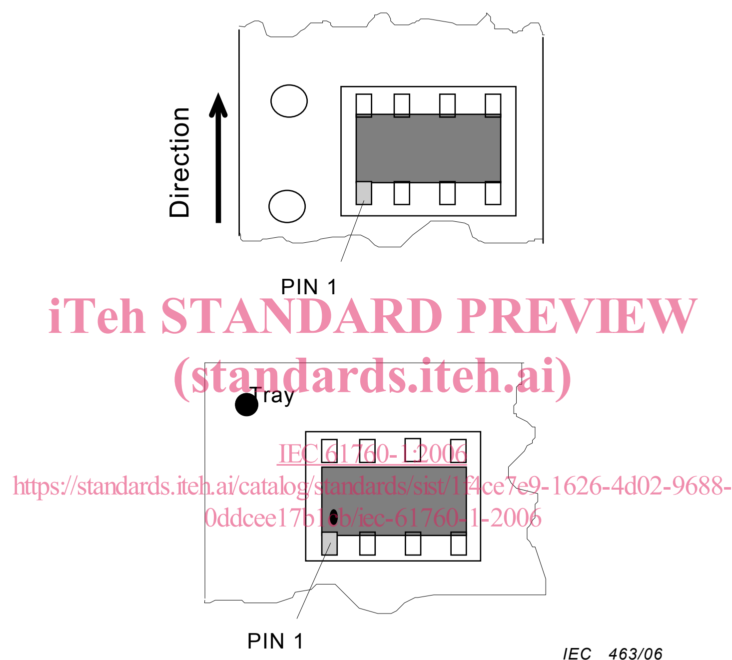

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Figure 1 – Example of a component with marked specific orientation put in tape and tray

4.4 Component marking

4.4.1 Marking of multipin components

Pin 1 (see Figure 1) shall be clearly marked on a multipin component (e.g. SO-IC, QFP).

4.4.2 Marking of components with polarity

For components with polarity, the polarity of the component shall be clearly marked on the component (e.g. for electrolytic capacitors).

4.4.3 Durability of component marking

Specifications shall require that the specified component marking shall remain legible after the test specified in 7.5.2 has been performed. This test shall be performed after completion of the relevant test for resistance to soldering heat or for solderability, as specified in the component specification.

4.5 Storage and transportation

Component specifications shall refer to IEC 61760-2 for storage and transportation conditions.

The component specification shall contain information concerning the maximum period for storage. Within this period the component shall comply with its specification.

4.6 Component outline and design

4.6.1 Drawing and specification

An inverted-plan view of the component showing all dimensions and tolerances of its body and terminals shall be part of the component specification. The plan shall include reference to the positioning of the component body and terminals on the mounting land pattern.

Where necessary (e.g. in the case of mechanically fixed components with an overall length of more than 25 mm), the detail specification shall contain data on thermal expansion, at least along the X and Y axes.

4.6.2 Pick-up area requirements

Design of the component shall take into account that it shall be possible to grip the component by suction and transport it to the exact placement position on the substrate. It shall be possible to create a vacuum strong enough to fix the component in its position under the pipette. During the total transport process, which may include optical inspection, the component shall remain exactly in its position under the pipette, until the component is placed.

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The centre of the suction area should match the centre of gravity and the geometrical centre.

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The opening of the pipette (Y), the dimension (L) of the component or its pick up area (X) and the tolerances on the position of the component inside the compartment of packaging with length dimension (A_0) and width dimension (B_0) shall match in such a way, that the vacuum needed for pick up can be created. It shall be possible to apply the vacuum irrespective of the component's position in its compartment.

For further requirements concerning the position of the component inside the packaging, see IEC 60286-3 for taping and IEC 60286-5 for matrix trays.

NOTE Dimension L may be the length or the width of the component, as applicable.

Requirement: $X - Y > Z$

$$Z = (Z_1 + Z_2) = (A_0 - L)$$

$$Z = (Z_1 + Z_2) = (B_0 - L)$$

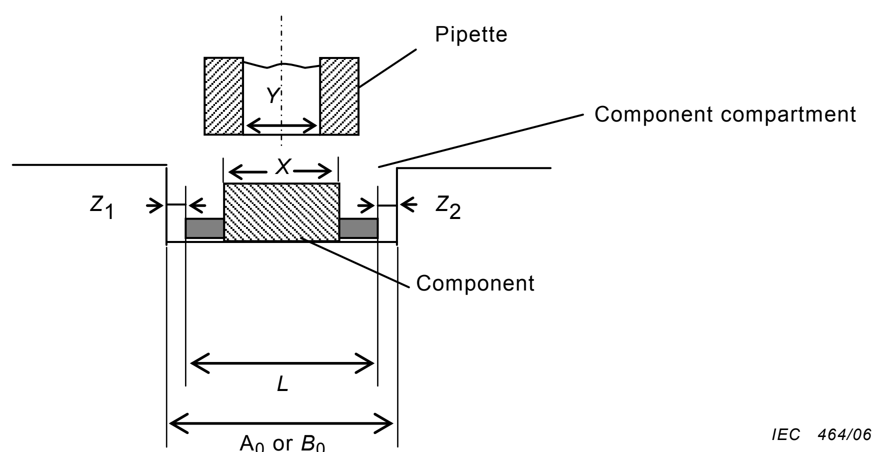

Figure 2 – Vacuum pipette, pick-up area and component compartment: Example for a component with a flat surface

4.6.3 Bottom surface requirements

In cases where the component is to be bonded to the substrate with adhesive, its lower surface (except for the terminals) must be capable of retaining the applied adhesive.

The stand-off between the lower surface of bonded components and the seating plane shall be specified. The detail specification shall state the maximum stand-off. Normally a value of 0,3 mm should not be exceeded.

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For components which are fixed by an additional fixing adhesive or in case a cleaning process is used the minimum stand-off should be included in the component specification, because with use of the additional fixing adhesive all pins have to be inside the material for the electrical connection (solder paste or conductive adhesive).

4.6.4 Requirements for terminals

4.6.4.1 Coplanarity

Detail specifications of multipin components intended for reflow soldering/ conductive gluing shall state the coplanarity of the lower surfaces of all terminals in accordance with 3.5 of IEC 60191-6:2004. The typical value of coplanarity needed for reflow soldering is 0,1 mm – 0,15 mm, but depends on the size of the component and the thickness of printed solder. The components terminals shall be sufficiently coplanar to ensure that contact is made with the solder on the solder surfaces after solder printing or with the conductive adhesive. Detail specifications of two pin components for mounting with conductive adhesive shall state the coplanarity of both terminals in relation to the bottom surface of the component.

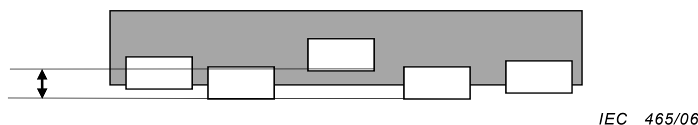

Figure 3 – Coplanarity of terminals

4.6.4.2 Arrangement of terminals

The terminals shall be arranged in such a way that stable seating in the solder paste or glue is ensured and tilting is avoided (see Figures 4, 5 and 6).