IEC 61760-1

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INTERNATIONAL STANDARD

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

Technique du montage en surface – Partie 1: Méthode normalisée 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 ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SURFACE MOUNTING TECHNOLOGY –

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

FOREWORD

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

This third edition cancels and replaces the second edition published in 2006. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) inclusion of additional mounting methods: conductive glue bonding, sintering and solderless interconnection.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
91/1648/FDIS	91/1653/RVD

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

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

A list of all parts in the IEC 61760 series, published under the general title *Surface mounting technology*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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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 intention 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 different mounting processes on one assembly make it necessary to extend the existing requirements to include those arising from processing during assembly.

Nevertheless, there existed no harmonized standard that prescribes the content of a component specification before the publication of IEC 61760-1. It is the purpose of this document 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 requirements related to assembly processes are given (Clause 5). In the third step, additional requirements resulting from specific mounting methods are given (Clauses 6 to 9).

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 document.

SURFACE MOUNTING TECHNOLOGY –

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

1 Scope

This part of IEC 61760 defines requirements for component specifications of electronic components that are intended for usage in surface mounting technology. To this end, it specifies a reference set of process conditions and related test conditions to be considered when compiling component specifications.

The objective of this document is to ensure that a wide variety of SMDs can be subjected to the same placement, mounting and subsequent processes (e.g. cleaning, inspection) during assembly. This document defines tests and requirements that need to be part of any SMD component's general, sectional or detail specification. In addition, this document provides component users and manufacturers with a reference set of typical process conditions used in surface mounting technology.

Some of the requirements for component specifications in this document are also applicable to components with leads intended for mounting on a circuit board. Cases for which this is appropriate are indicated in the relevant subclauses.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60068 (all parts), *Environmental testing*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

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

IEC 60068-2-45:1980, *Basic environmental testing procedures – Part 2-45: Tests – Test XA and guidance: Immersion in cleaning solvents*
IEC 60068-2-45:1980/AMD1:1993

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

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

IEC 60194-2, *Printed boards design, manufacture and assembly – Vocabulary – Part 2: Common usage in electronic technologies as well as printed board and electronic assembly technologies*

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 different forms*

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 60749-20:2008, *Semiconductor devices – Mechanical and climatic test methods – Part 20: Resistance of plastic encapsulated SMDs to the combined effect of moisture and soldering heat*

IEC 61188-6-4, *Printed boards and printed board assemblies – Design and use – Part 6-4: Land pattern design – Generic requirements for dimensional drawings of surface mounted components (SMD) from the viewpoint of land pattern design*

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 – Properties and requirements classification for packaging intended for electrostatic discharge sensitive devices*

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

IEC 61760-4, *Surface mounting technology – Part 4: Classification, packaging, labelling and handling of moisture sensitive devices*

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

IPC/JEDEC J-STD-020, *Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Devices*

IPC/JEDEC J-STD-033, *Handling, Packaging, Shipping, and Use of Moisture/Reflow Sensitive Surface Mount Devices*

3 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 60194-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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

Note 1 to entry: In surface mounting technology different gluing systems are used:

– nonconductive adhesive (only for mechanical connection);
– electrically conductive adhesive (for electrical and mechanical connection);
– thermally conductive adhesive (for thermal and mechanical connection);
– combination of electrically and thermally 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

Note 1 to entry: For the purposes 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 to 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

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)

Note 1 to entry: The maximum level is normally taken into account.

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

Note 1 to entry: 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 that forms the support structure of an electronic circuit

3.17
SMD
surface mounting component
surface mounting device
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 4.9, contain specifications of the relevant tests and requirements from Clauses 5 to 9.

4.2 Component marking

4.2.1 Marking of multipin components

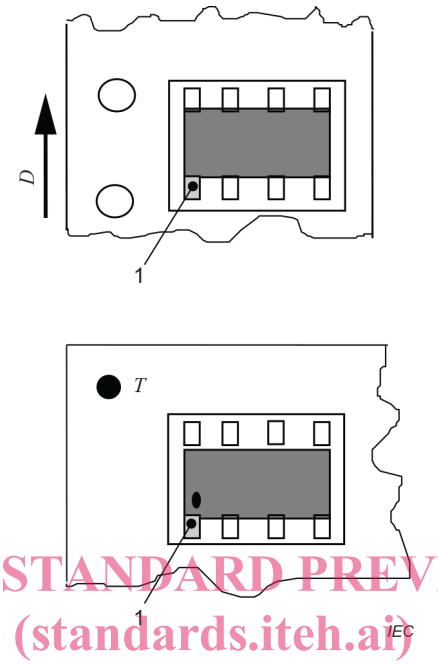
Pin 1 (see Figure 1) shall be clearly marked on a multipin component (e.g. SO-IC, QFP).

4.2.2 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).

4.2.3 Durability of component marking

Specifications shall require that the specified component marking shall remain legible after the test specified in 5.4 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.



Key

D direction of unreeling

T tray

1 pin 1 of the component

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

4.3 Component outline and design

4.3.1 Drawing and specification

Drawings, including bottom-view, top-view and side-view drawings, of the component showing all dimensions and tolerances of its body and terminals shall be part of the component specification. The drawings shall include reference to the positioning of the component body and terminals on the mounting land pattern. If conductive surfaces are not planar, their three-dimensional geometry shall be clearly specified with the relevant tolerances. An example is the presence of grooves on thermal pads of QFP.

In any 2D drawing or 3D data, conductive parts and/or surfaces and insulating parts/surfaces shall be clearly distinguished, at least for the bottom and the sides of components, as well as for movable parts. This requirement applies both to the disassembled and the assembled condition for parts requiring a final assembly step after mounting on a substrate (e.g. if a connector contains spring-loaded retainers whose position and/or angle changes upon mating). The locations and dimensions of conductive parts/surfaces shall be specified, even if they are not intended for establishing a contact with the mounting surface, for example punched or sawn surfaces consisting of unplated leadframe resulting from component singulation for moulded semiconductor packages.

The generic requirements for dimensional drawings of SMDs from the viewpoint of land-pattern design as specified in IEC 61188-6-4 shall be adopted for surface mounting devices.

Where necessary (e.g. in the case of large 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. In the case of mechanical fixation of large components (e.g. by screwing), mismatch of the coefficients of thermal expansion between component and mounting substrate can result in warping of the component and the mounting substrate.

For components singulated by punching or sawing, for which parts of the terminals may not wet during a soldering operation owing to the absence of a surface finish preserving a solderable surface on the leadframe, such surfaces shall be indicated in the drawing.

For bottom-termination components (BTCs) as QFNs (quad-flat no lead packages), DFNs (dual-flat no lead packages), etc., for which a wettable-flank pin modification has been applied to assure the formation of an outer fillet in reflow soldering, the minimum height of the plated flank of the leadframe shall be indicated in the drawing.

NOTE 1 For components intended for high-reliability applications, such as automotive and aerospace industries, the height of the wettable portion typically is larger than 100 µm to enable a robust automated solder-joint inspection.

NOTE 2 The presence of an outer fillet, as enabled by a wettable-flank pin modifciation, generally increases the reliability of the solder joints under environmental loads such as thermal cycling.

4.3.2 Termination design

The relevant specification shall provide information on termination design (i.e. the termination base material, layer structure and finish).

4.3.3 Pick-up area requirements

The design of the component shall consider that it shall be possible to grip the component by suction and transport it to its 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.

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

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 (see Figure 2 for an illustration of the geometrical dimensions). 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, IEC 60286-4 for stick magazines and IEC 60286-5 for matrix trays.

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

Requirement: $X - Y > Z$

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

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