

# Printed boards and printed board assemblies — Design and use —

## Part 5-3: Attachment (land/joint) considerations — Components with gull-wing leads on two sides

The European Standard EN 61188-5-3:2007 has the status of a  
British Standard

ICS 31.180

# National foreword

This British Standard is the UK implementation of EN 61188-5-3:2007. It is identical to IEC 61188-5-3:2007.

The UK participation in its preparation was entrusted to Technical Committee EPL/501, Electronic assembly technology.

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.

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2007

© BSI 2007

ISBN 978 0 580 60178 1

## Amendments issued since publication

| Amd. No. | Date | Comments |
|----------|------|----------|
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |

**Printed boards and printed board assemblies -  
Design and use -  
Part 5-3: Attachment (land/joint) considerations -  
Components with gull-wing leads on two sides  
(IEC 61188-5-3:2007)**

Cartes imprimées et  
cartes imprimées équipées -  
Conception et utilisation -  
Partie 5-3: Considérations  
sur les liaisons pistes-soudures -  
Composants à sorties  
en aile de mouette sur deux côtés  
(CEI 61188-5-3:2007)

Leiterplatten und Flachbaugruppen -  
Konstruktion und Anwendung -  
Teil 5-3: Betrachtungen zur Montage  
(Anschlussfläche/Verbindung) -  
Bauelemente mit  
Gullwing-Anschlüssen  
auf zwei Seiten  
(IEC 61188-5-3:2007)

This European Standard was approved by CENELEC on 2007-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## **Foreword**

The text of document 91/702/FDIS, future edition 1 of IEC 61188-5-3, prepared by IEC TC 91, Electronics assembly technology, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61188-5-3 on 2007-11-01.

This standard is to be used in conjunction with EN 61188-5-1.

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) 2008-08-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2010-11-01

Annex ZA has been added by CENELEC.

---

## **Endorsement notice**

The text of the International Standard IEC 61188-5-3:2007 was approved by CENELEC as a European Standard without any modification.

---

## CONTENTS

|                                                                                                                                 |    |
|---------------------------------------------------------------------------------------------------------------------------------|----|
| INTRODUCTION.....                                                                                                               | 5  |
| 1 Scope.....                                                                                                                    | 6  |
| 2 Normative references .....                                                                                                    | 6  |
| 3 General information .....                                                                                                     | 6  |
| 3.1 General component description .....                                                                                         | 6  |
| 3.2 Marking .....                                                                                                               | 6  |
| 3.3 Carrier packaging format .....                                                                                              | 6  |
| 3.4 Process considerations .....                                                                                                | 6  |
| 4 TSOP (Type 1) .....                                                                                                           | 7  |
| 4.1 Field of application .....                                                                                                  | 7  |
| 4.2 Component description.....                                                                                                  | 7  |
| 4.3 Component dimensions .....                                                                                                  | 7  |
| 4.4 Solder joint fillet design .....                                                                                            | 8  |
| 4.5 Land pattern dimensions .....                                                                                               | 10 |
| 5 TSOP (Type 2) .....                                                                                                           | 11 |
| 5.1 Field of application .....                                                                                                  | 12 |
| 5.2 Component description.....                                                                                                  | 12 |
| 5.3 Component dimensions .....                                                                                                  | 12 |
| 5.4 Solder joint fillet design .....                                                                                            | 13 |
| 5.5 Land pattern dimensions .....                                                                                               | 15 |
| 6 SOP .....                                                                                                                     | 17 |
| 6.1 Field of application .....                                                                                                  | 17 |
| 6.2 Component description.....                                                                                                  | 17 |
| 6.3 Component dimensions .....                                                                                                  | 17 |
| 6.4 Solder joint fillet design .....                                                                                            | 18 |
| 6.5 Land pattern dimensions .....                                                                                               | 20 |
| 7 SSOP .....                                                                                                                    | 22 |
| 7.1 Field of application .....                                                                                                  | 22 |
| 7.2 Component description.....                                                                                                  | 22 |
| 7.3 Component dimensions .....                                                                                                  | 23 |
| 7.4 Solder joint fillet design .....                                                                                            | 23 |
| 7.5 Land pattern dimensions .....                                                                                               | 25 |
| Annex ZA (normative) Normative references to international publications with their<br>corresponding European publications ..... | 29 |
| Bibliography.....                                                                                                               | 28 |
| Figure 1 – TSOP (Type 1) construction .....                                                                                     | 7  |
| Figure 2 – TSOP (Type 1) – Component dimensions.....                                                                            | 8  |
| Figure 3 – Solder joint fillet design (see IEC 61188-5-1, Tables 2 and 3) .....                                                 | 10 |
| Figure 4 – TSOP (Type 1) – Land pattern dimensions .....                                                                        | 12 |
| Figure 5 – TSOP (Type 2) construction .....                                                                                     | 12 |
| Figure 6 – TSOP (Type 2) – Component dimensions.....                                                                            | 13 |
| Figure 7 – Solder joint fillet design (see IEC 61188-5-1, Tables 2 and 3) .....                                                 | 15 |
| Figure 8 – TSOP (Type 2) – Land pattern dimensions .....                                                                        | 17 |

|                                                                          |    |
|--------------------------------------------------------------------------|----|
| Figure 9 – SOPIC construction.....                                       | 17 |
| Figure 10 – SOP component dimensions .....                               | 18 |
| Figure 11 – Solder joint fillet design (see IEC 61188-5-1, Table 2)..... | 20 |
| Figure 12 – SOP Land pattern dimensions .....                            | 22 |
| Figure 13 – SSOP construction .....                                      | 22 |
| Figure 14 – Component dimensions .....                                   | 23 |
| Figure 15 – Solder joint fillet design (see IEC 61188-5-1, Table 2)..... | 25 |
| Figure 16 – Land pattern dimensions .....                                | 27 |

## INTRODUCTION

This part of IEC 61188 covers land patterns for components with gull-wing leads on two sides. Each clause contains information in accordance with the following format:

The proposed land pattern dimensions in this standard are based upon the fundamental tolerance calculation combined with the given land protrusions and courtyard excesses (see IEC 61188-5-1, Generic requirements). The courtyard includes all issues of the normal manufacturing necessities.

The unaltered land pattern dimensions of this part are generally applicable for the solder paste application plus reflow soldering process. For application of the wave soldering process, the land pattern dimensions normally have to be modified. Orientation parallel to the wave direction is preferable and special, suitably dimensioned solder thieves should be added.

This standard offers a threefold land pattern dimensioning (levels 1, 2, and 3) on the basis of a threefold set of land protrusions and courtyard excesses: maximum (max.); median (mdn) and minimum (min.). Each land pattern has been assigned an identification number to indicate the characteristics of the specific robustness of the land patterns. Users also have the opportunity to organize the information so that it is most useful for their particular design.

If a user has good reason to use a concept different from that of IEC 61188-5-1 or if the user prefers unusual land protrusions, this standard should be used for checking the resulting solder fillet size.

It is the responsibility of the user to verify the SMD land patterns used for achieving an undisturbed mounting process including testing and an ensured reliability for the product stress conditions in use.

Component dimensions listed in this standard are those available on the market and regarded as for reference only.

## PRINTED BOARDS AND PRINTED BOARD ASSEMBLIES – DESIGN AND USE –

### Part 5-3: Attachment (land/joint) considerations – Components with gull-wing leads on two sides

#### 1 Scope

This part of IEC 61188 provides information on land pattern geometries used for the surface attachment of electronic components with gull-wing leads on two sides. The intent of the information presented herein is to provide the appropriate size, shape and tolerances of surface mount land patterns to ensure sufficient area for the appropriate solder fillet, and also allow for inspection, testing and reworking of those solder joints.

Each clause contains a specific set of criteria such that the information presented is consistent, providing information on the component, the component dimensions, the solder joint design, and the land pattern dimensions.

#### 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.

IEC 61188-5-1, *Printed boards and printed board assemblies – Design and use – Part 5-1: Attachment (land/joint) considerations – Generic requirements*

#### 3 General information

##### 3.1 General component description

The acronyms TSOP (thin small outline package), SOP (small outline package) and SSOP (shrink small outline package) are also used to describe the family.

##### 3.2 Marking

The TSOP, SOP and SSOP families of parts are generally marked with the manufacturer's part numbers, manufacturer's name or symbol, and a pin 1 indicator. Some parts may have a pin 1 feature in the case shape instead of pin 1 marking. Additional markings may include date-code manufacturing lot and/or manufacturing location.

##### 3.3 Carrier packaging format

Carrier packaging format may be provided in a tray carrier, but tape and reel carriers are preferred for best handling and high volume applications. Bulk packaging is not acceptable because of lead co-planarity required for placement and soldering.

##### 3.4 Process considerations

TSOP, SOP and SSOP packages are normally processed by reflow solder operations.

The land pattern dimensions are based on a mathematical model that establishes a platform for a solder joint attachment to the printed board. The existing models create a platform

capable of establishing a reliable solder joint no matter what solder alloy is used to make that joint (lead-free, tin lead, etc.)

Process requirements for solder reflow are different based on the solder alloy and should be analyzed in order that the process is above the liquidus temperature of the alloy, and remains above that temperature a sufficient time to form a reliable metallurgical bond.

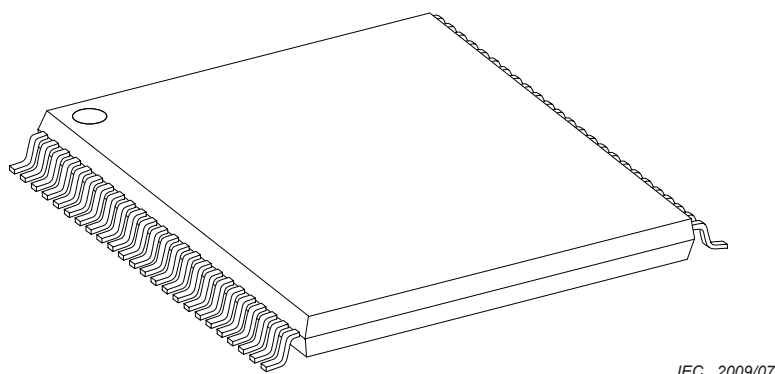
## 4 TSOP (Type 1)

### 4.1 Field of application

This clause provides the component and land pattern dimensions for TSOP (Type 1) components. Basic construction is also covered. Subclause 4.4 lists the tolerances and target solder joint dimensions used to arrive at the land pattern dimensions.

### 4.2 Component description

Figure 1 shows a typical construction example.



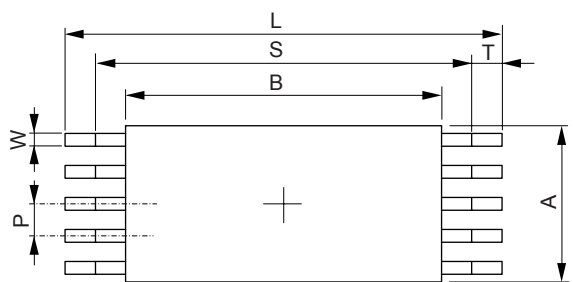
IEC 2009/07

**Figure 1 – TSOP (Type 1) construction**

### 4.3 Component dimensions

Figure 2 shows the component dimensions for TSOP (Type 1) components.

Land pattern dimensional data may need to be adjusted if the component dimensional data does not match JEDEC and/or JEITA data sheets.



IEC 2010/07

Dimensions in millimetres

| Component identification | Pin count | L    |      | W    |      | T    |      | S*   |       | A     |       | B    |      | H    | P     |
|--------------------------|-----------|------|------|------|------|------|------|------|-------|-------|-------|------|------|------|-------|
|                          |           | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max.  | Min.  | Max.  | Min. | Max. | Max. | Basic |
| TSOP 6x14                | 16        | 13,8 | 14,2 | 0,17 | 0,27 | 0,40 | 0,75 | 12,3 | 12,94 | 5,80  | 6,20  | 12,2 | 12,6 | 1,20 | 0,65  |
| TSOP 6x16                | 24        | 15,8 | 16,2 | 0,17 | 0,23 | 0,40 | 0,75 | 14,3 | 14,94 | 5,80  | 6,20  | 14,2 | 14,6 | 1,20 | 0,5   |
| TSOP 6x18                | 28        | 17,8 | 18,2 | 0,13 | 0,19 | 0,40 | 0,75 | 16,3 | 16,94 | 5,80  | 6,20  | 16,2 | 16,6 | 1,20 | 0,4   |
| TSOP 6x20                | 36        | 19,8 | 20,2 | 0,09 | 0,15 | 0,40 | 0,75 | 18,3 | 18,94 | 5,80  | 6,20  | 18,2 | 18,6 | 1,20 | 0,3   |
| TSOP 8x14                | 24        | 13,8 | 14,2 | 0,17 | 0,27 | 0,40 | 0,75 | 12,3 | 12,94 | 7,80  | 8,20  | 12,2 | 12,6 | 1,20 | 0,65  |
| TSOP 8x16                | 32        | 15,8 | 16,2 | 0,17 | 0,23 | 0,40 | 0,75 | 14,3 | 14,94 | 7,80  | 8,20  | 14,2 | 14,6 | 1,20 | 0,5   |
| TSOP 8x18                | 40        | 17,8 | 18,2 | 0,13 | 0,19 | 0,40 | 0,75 | 16,3 | 16,94 | 7,80  | 8,20  | 16,2 | 16,6 | 1,20 | 0,4   |
| TSOP 8x20                | 52        | 19,8 | 20,2 | 0,09 | 0,15 | 0,40 | 0,75 | 18,3 | 18,94 | 7,80  | 8,20  | 18,2 | 18,6 | 1,20 | 0,3   |
| TSOP 10x14               | 28        | 13,8 | 14,2 | 0,17 | 0,27 | 0,40 | 0,75 | 12,3 | 12,94 | 9,80  | 10,20 | 12,2 | 12,6 | 1,20 | 0,65  |
| TSOP 10x16               | 40        | 15,8 | 16,2 | 0,17 | 0,23 | 0,40 | 0,75 | 14,3 | 14,94 | 9,80  | 10,20 | 14,2 | 14,6 | 1,20 | 0,5   |
| TSOP 10x18               | 48        | 17,8 | 18,2 | 0,13 | 0,19 | 0,40 | 0,75 | 16,3 | 16,94 | 9,80  | 10,20 | 16,2 | 16,6 | 1,20 | 0,4   |
| TSOP 10x20               | 64        | 19,8 | 20,2 | 0,09 | 0,15 | 0,40 | 0,75 | 18,3 | 18,94 | 9,80  | 10,20 | 18,2 | 18,6 | 1,20 | 0,3   |
| TSOP 12x14               | 36        | 13,8 | 14,2 | 0,17 | 0,27 | 0,40 | 0,75 | 12,3 | 12,94 | 11,80 | 12,20 | 12,2 | 12,6 | 1,20 | 0,65  |
| TSOP 12x16               | 48        | 15,8 | 16,2 | 0,17 | 0,23 | 0,40 | 0,75 | 14,3 | 14,94 | 11,80 | 12,20 | 14,2 | 14,6 | 1,20 | 0,5   |
| TSOP 12x18               | 60        | 17,8 | 18,2 | 0,13 | 0,19 | 0,40 | 0,75 | 16,3 | 16,94 | 11,80 | 12,20 | 16,2 | 16,6 | 1,20 | 0,4   |
| TSOP 12x20               | 76        | 19,8 | 20,2 | 0,09 | 0,15 | 0,40 | 0,75 | 18,3 | 18,94 | 11,80 | 12,20 | 18,2 | 18,6 | 1,20 | 0,3   |

\* Calculated value.

Figure 2 – TSOP (Type 1) – Component dimensions

#### 4.4 Solder joint fillet design

Figure 3 shows the dimensions of the solder fillet after the soldering process. The minimum, median and maximum dimensions of each of toe, heel and side fillet are determined by taking into consideration solder joint reliability and also quality and productivity in the mounting process of parts.

In designing land patterns, three accuracy factors need to be taken into consideration:

- parts dimensions accuracy (C);
- parts mount accuracy on PWBs (P);
- land shape accuracy of PWBs (F),

in addition to fillet dimensions. The formulae to obtain the tolerance resulting from these factors are basically as follows:

##### a) Design consideration when soldered without self-alignment effect (level 1)

In the flow soldering process, there is no self-alignment effect. Thus, the formulae cannot be simplified but remain the same, as follows: