

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Circuit boards and circuit board assemblies – Design and use –
Part 6-1: Land pattern design – Generic requirements for land pattern on
circuit boards**

**Cartes imprimées et cartes imprimées équipées – Conception et utilisation –
Partie 6-1: Conception de la zone de report – Exigences génériques pour la zone
de report sur les cartes imprimées**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2021 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC online collection - oc.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Circuit boards and circuit board assemblies – Design and use –
Part 6-1: Land pattern design – Generic requirements for land pattern on
circuit boards**

**Cartes imprimées et cartes imprimées équipées – Conception et utilisation –
Partie 6-1: Conception de la zone de report – Exigences génériques pour la zone
de report sur les cartes imprimées**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.180; 31.190

ISBN 978-2-8322-9443-7

Warning! Make sure that you obtained this publication from an authorized distributor. Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.
--

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Design requirements.....	10
4.1 General.....	10
4.2 Product classification	10
4.3 General surface mount land and land pattern requirements.....	11
4.4 Component packages and soldering process	11
4.5 Soldering surface requirements.....	11
4.5.1 Main soldering techniques	11
4.5.2 Reflow soldering	11
4.5.3 Reflow soldering of leaded components.....	12
4.5.4 Wave soldering of surface mounted components	12
4.5.5 Wave soldering of through-hole mounted components	14
4.6 Soldering surface definition techniques	15
4.6.1 General	15
4.6.2 Metal defined lands	15
4.6.3 Solder mask defined lands.....	15
4.6.4 Comparison of solder mask defined and non solder mask defined solderable surfaces	16
5 Component classification	16
5.1 General.....	16
5.2 Leaded components.....	16
5.3 Surface mount components.....	17
6 The proportional dimensioning system.....	17
7 Terminal classification	18
7.1 Leaded terminals	18
7.2 Surface mount terminals	18
7.2.1 Terminal classes.....	18
7.2.2 Flat bottom terminals	18
7.2.3 General land requirements for flat bottom terminals.....	19
7.2.4 Flat bottom and vertical side terminals.....	19
7.2.5 General land requirements for flat bottom and vertical side terminals	20
8 Requirements for lands of solder joints	20
8.1 Land/Pad dimensioning considerations of leaded terminals.....	20
8.2 Land dimensioning considerations of surface mount terminals	20
Annex A (informative) Dimensioning concept of former IEC 61188-5-1.....	21
A.1 Dimensioning systems	21
A.1.1 General	21
A.1.2 Component tolerancing.....	22
A.1.3 Solving for dimension Z	25
A.1.4 Land tolerancing.....	25
A.1.5 Fabrication allowances	25
A.1.6 Assembly tolerancing.....	26

A.1.7	Dimension and tolerance analysis.....	27
Annex B (informative)	History of land dimensioning standards	29
B.1	IPC-782	29
B.2	IEC 61188-5 series	29
B.3	IPC-7351	29
Bibliography		30
Figure 1	– Component placed on solder paste	12
Figure 2	– Component glued for wave soldering.....	13
Figure 3	– Wave soldered component with solder thieves	14
Figure 4	– Solder joint of a leaded component	15
Figure 5	– Leaded component – Capacitor.....	17
Figure 6	– Surface mount component – Chip capacitor	17
Figure 7	– Flat bottom terminals with wettable flanks	18
Figure A.1	– Profile tolerancing method	21
Figure A.2	– Example of 3216M capacitor dimensioning for optimum solder fillet condition	22
Figure A.3	– Profile dimensioning of gull-wing leaded SOIC	23
Figure A.4	– Pitch for multiple leaded component	28
Table 1	– Flat bottom terminals.....	19
Table 2	– Flat bottom/vertical side terminals	19
Table A.1	– Conductor width tolerances	26
Table A.2	– Feature location accuracy	26

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CIRCUIT BOARDS AND CIRCUIT BOARD ASSEMBLIES – DESIGN AND USE –

Part 6-1: Land pattern design – Generic requirements for land pattern on circuit boards

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61188-6-1 has been prepared by IEC technical committee 91: Electronics assembly technology. It is an International Standard.

This first edition cancels and replaces the first edition of IEC 61188-5-1 published in 2002, and constitutes a technical revision.

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

- a) The content is completely updated to reflect current industry requirements. See Introduction.

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

Draft	Report on voting
91/1636/CDV	91/1671/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 61188 series, published under the general title *Circuit boards and circuit board assemblies – Design and use*, can be found on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Explanation why the following standards will be replaced by the new IEC 6188-6 series:

IEC 61188-5-1:2002, *Printed boards and printed board assemblies – Design and use – Part 5-1: Attachment (land/joint) considerations – Generic requirements*

IEC 61188-5-2:2003, *Printed boards and printed board assemblies – Design and use – Part 5-2: Attachment (land/joint) considerations – Discrete components*

IEC 61188-5-3:2007, *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 61188-5-4:2007, *Printed boards and printed board assemblies – Design and use – Part 5-4: Attachment (land/joint) considerations – Components with J leads on two sides*

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

IEC 61188-5-6:2003, *Printed boards and printed board assemblies – Design and use – Part 5-6: Attachment (land/joint) considerations – Chip carriers with J-leads on four sides*

IEC 61188-5-8:2007, *Printed board and printed board assemblies – Design and use – Part 5-8: Attachment (land/joint) considerations – Area array components (BGA, FBGA, CGA, LGA)*

Content is mostly equivalent to IPC-782A with Amendments 1 and 2, which was replaced in 2002 by IPC-7351. The component spectrum and pitch levels have dramatically increased since publication of the IEC 61188-5 (all parts) and the dimensioning concept does no longer fulfil the mounting and soldering requirements.