

INTERNATIONAL STANDARD



**Printed board assemblies –
Part 2: Sectional specification – Requirements for surface mount soldered
assemblies**





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2017 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.

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

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 It also gives information on projects, replaced and withdrawn publications.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 also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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: csc@iec.ch.



IEC 61191-2

Edition 3.0 2017-05

INTERNATIONAL STANDARD



**Printed board assemblies –
Part 2: Sectional specification – Requirements for surface mount soldered
assemblies**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.190; 31.240

ISBN 978-2-8322-4322-0

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 General requirements	7
5 Surface mounting of components.....	7
5.1 General.....	7
5.2 Alignment requirements	8
5.3 Process control.....	8
5.4 Surface mounted component requirements	8
5.5 Flatpack lead forming.....	8
5.5.1 General	8
5.5.2 Surface mounted device lead bends	8
5.5.3 Surface mounted device lead deformation	9
5.5.4 Flattened leads.....	9
5.5.5 Dual-in-line packages (DIPs)	9
5.5.6 Parts not configured for surface mounting.....	9
5.6 Small devices with two terminations.....	9
5.6.1 General	9
5.6.2 Stack mounting.....	9
5.6.3 Devices with external deposited elements.....	9
5.7 Lead component body positioning.....	10
5.7.1 General	10
5.7.2 Axial-leaded components.....	10
5.7.3 Other components	10
5.8 Parts configured for butt lead mounting.....	10
5.9 Non-conductive adhesive coverage limits.....	10
6 Acceptance requirements	10
6.1 General.....	10
6.2 Control and corrective actions.....	10
6.3 Surface soldering of leads and terminations.....	11
6.3.1 General	11
6.3.2 Solder fillet height and heel fillets	11
6.3.3 Flat ribbon L and gull-wing leads	12
6.3.4 Round or flattened (coined) leads	13
6.3.5 J leads.....	14
6.3.6 Rectangular or square end component	15
6.3.7 Cylindrical end-cap terminations	16
6.3.8 Bottom only terminations	17
6.3.9 Castellated terminations	18
6.3.10 Butt joints	19
6.3.11 Inward L-shaped ribbon leads.....	20
6.3.12 Flat lug leads.....	21
6.3.13 Ball grid array	22
6.3.14 Column grid array	23
6.3.15 Bottom termination components.....	24

6.3.16	Components with bottom thermal plane terminations (D-Pak)	24
6.3.17	P-style terminations	26
6.4	General post-soldering requirements applicable to all surface-mounted assemblies	26
6.4.1	Dewetting	26
6.4.2	Leaching	26
6.4.3	Pits, voids, blowholes, and cavities	26
6.4.4	Solder wicking	27
6.4.5	Solder webs and skins	27
6.4.6	Bridging	27
6.4.7	Degradation of marking	27
6.4.8	Solder spikes	27
6.4.9	Disturbed joint	27
6.4.10	Component damage	27
6.4.11	Open circuit, non-wetting	27
6.4.12	Component tilting	27
6.4.13	Non-conducting adhesive encroachment	28
6.4.14	Open circuit, no solder available	28
6.4.15	Component on edge	28
7	Rework and repair	28
Annex A (normative)	Placement requirements for surface mounted devices	30
A.1	General	30
A.2	Component positioning	30
A.3	Small devices incorporating two terminations	30
A.3.1	Metallization coverage over the land (side-to-side)	30
A.3.2	Metallization coverage over the land (end)	30
A.4	Mounting of cylindrical end-cap devices (MELFs)	30
A.5	Registration of castellated chip carriers	30
A.6	Surface mounted device lead and land contact	30
A.7	Surface mounted device lead side overhang	30
A.8	Surface mounted device lead toe overhang	31
A.9	Surface mounted device lead height off land (prior to soldering)	31
A.10	Positioning of J lead devices	31
A.11	Positioning gull-wing lead devices	31
A.12	External connections to packaging and interconnect structures	31
	Bibliography	32
	Figure 1 – Lead formation for surface mounted device	8
	Figure 2 – Fillet height	12
	Figure 3 – Flat ribbon and gull-wing leads	13
	Figure 4 – Round or flattened (coined) lead joint	14
	Figure 5 – J lead joint	15
	Figure 6 – Rectangular or square end components	16
	Figure 7 – Cylindrical end-cap terminations	17
	Figure 8 – Bottom only terminations	18
	Figure 9 – Leadless chip carriers with castellated terminations	19
	Figure 10 – Butt joints	20

Figure 11 – Inward L-shaped ribbon leads	21
Figure 12 – Flat lug leads	22
Figure 13 – BGA with collapsing balls	23
Figure 14 – Bottom termination components	24
Figure 15 – Bottom thermal plane terminations	25
Figure 16 – P-style terminations	26
Table 1 – BGA with non-collapsing balls	23
Table 2 – Column grid array.....	23
Table 3 – Reworkable defects.....	29

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRINTED BOARD ASSEMBLIES –**Part 2: Sectional specification –
Requirements for surface mount soldered assemblies**

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.

International Standard IEC 61191-2 has been prepared by IEC technical committee 91: Electronics assembly technology.

This third edition cancels and replaces the second edition published in 2013. This edition constitutes a technical revision.

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

- a) the requirements have been updated to be compliant with the acceptance criteria in IPC-A-610F;
- b) some of the terminology used in the document has been updated;
- c) references to IEC standards have been corrected;
- d) five termination styles have been added.

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

CDV	Report on voting
91/1386/CDV	91/1429/RVC

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 of IEC 61191 under the general title *Printed board assemblies* can be found in 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.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

PRINTED BOARD ASSEMBLIES –

Part 2: Sectional specification – Requirements for surface mount soldered assemblies

1 Scope

This part of IEC 61191 gives the requirements for surface mount solder connections. The requirements pertain to those assemblies that are totally surface mounted or to the surface mounted portions of those assemblies that include other related technologies (e.g. through-hole, chip mounting, terminal mounting, etc.).

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

IEC 61191-1, *Printed board assemblies – Part 1: Generic specification – Requirements for soldered electrical and electronic assemblies using surface mount and related assembly technologies*

IPC-A-610, *Acceptability of Electronic Assemblies*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60194 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>

4 General requirements

The requirements of IEC 61191-1 are a mandatory part of this specification.

Workmanship shall meet the requirements of IPC-A-610 in accordance with the classification requirements of this document.

5 Surface mounting of components

5.1 General

This clause covers assembly of components that are placed on the surface to be manually or machine soldered and includes components designed for surface mounting as well as through-hole components that have been adapted for surface mounting technology.