

INTERNATIONAL STANDARD

Printed board assemblies –
Part 3: Sectional specification – Requirements for through-hole mount soldered
assemblies

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 61191-3:2017](#)

<https://standards.iteh.ai/catalog/standards/iec/19189f70-f6fa-4cc3-9d4e-d6a20d6f62db/iec-61191-3-2017>



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 It also gives information on projects, replaced and withdrawn publications.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 61191-3:2017](https://standards.iteh.ai/catalog/standards/iec/19189f70-f6fa-4cc3-9d4e-d6a20d6f62db/iec-61191-3-2017)

<https://standards.iteh.ai/catalog/standards/iec/19189f70-f6fa-4cc3-9d4e-d6a20d6f62db/iec-61191-3-2017>



IEC 61191-3

Edition 2.0 2017-05

INTERNATIONAL STANDARD

Printed board assemblies –
Part 3: Sectional specification – Requirements for through-hole mount soldered assemblies

Document Preview

[IEC 61191-3:2017](https://standards.iteh.ai/catalog/standards/iec/19189f70-f6fa-4cc3-9d4e-d6a20d6f62db/iec-61191-3-2017)

<https://standards.iteh.ai/catalog/standards/iec/19189f70-f6fa-4cc3-9d4e-d6a20d6f62db/iec-61191-3-2017>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.240

ISBN 978-2-8322-4397-8

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

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 General requirements	6
5 Through-hole mounting of components	7
5.1 General.....	7
5.2 Placement accuracy.....	7
5.3 Through-hole component requirements	7
5.3.1 Lead preforming	7
5.3.2 Tempered leads.....	7
5.3.3 Lead forming requirements	7
5.3.4 Stress relief requirements.....	8
5.3.5 Lead termination requirements	8
6 Acceptance requirements	10
6.1 General.....	10
6.2 Control and corrective actions.....	10
6.2.1 General	10
6.2.2 Interfacial connections (vias)	10
6.3 Through-hole component lead soldering	11
6.3.1 General	11
6.3.2 Clinched leads.....	12
6.3.3 Exposed basis metal.....	13
7 Rework of unsatisfactory solder connections	13
Annex A (normative) Placement requirements for through-hole mount devices.....	14
A.1 General.....	14
A.2 Horizontal mounting, free-standing.....	14
A.3 Axial lead components	14
A.4 Radial lead components	14
A.5 Perpendicular mounting, free-standing.....	14
A.5.1 General	14
A.5.2 Mounting of components.....	14
A.5.3 Radial lead components	15
A.6 Side- and end-mounting	15
A.7 Supported component mounting.....	16
A.7.1 General	16
A.7.2 Stand-off positioning.....	16
A.7.3 Non-resilient footed stand-offs.....	17
A.8 Stress relief lead configuration.....	17
A.9 Flat pack lead configuration	17
Bibliography.....	19
Figure 1 – Lead bends	8
Figure 2 – Hole obstruction.....	10
Figure 3 – Through-hole component lead soldering.....	11

Figure 4 – Lead-to-land fillet requirements for clinched leads and wires in non-plated through-holes.....	11
Figure 5 – Lead-to-land fillet requirements for clinched leads and wires in plated through-holes.....	12
Figure A.1 – Mounting of free-standing components	14
Figure A.2 – Typical configuration of components with dual non-axial leads.....	15
Figure A.3 – Mounting of components with dual non-axial leads.....	15
Figure A.4 – Side mounting.....	15
Figure A.5 – End mounting.....	16
Figure A.6 – Mounting with footed stand-offs	16
Figure A.7 – Non-resilient footed stand-offs	17
Figure A.8 – Acceptable lead configurations	17
Figure A.9 – Configuration of ribbon leads for through-hole mounting	18
Table 1 – Plated through-holes with component leads, minimum acceptable conditions ¹⁾	12
Table 2 – Through-hole solder joint defects	13

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[IEC 61191-3:2017](#)

<https://standards.itih.ai/catalog/standards/iec/19189f70-f6fa-4cc3-9d4e-d6a20d6f62db/iec-61191-3-2017>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRINTED BOARD ASSEMBLIES –**Part 3: Sectional specification – Requirements
for through-hole 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 61191-3 has been prepared by WG 2: Requirements for electronics assemblies, of IEC technical committee 91: Electronics assembly technology.

This second edition cancels and replaces the first edition published in 1998. 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.

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

CDV	Report on voting
91/1375/CDV	91/1435/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 in the IEC 61191 series, published under the general title *Printed board assemblies*, 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.

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[IEC 61191-3:2017](#)

<https://standards.itih.ai/catalog/standards/iec/19189f70-f6fa-4cc3-9d4e-d6a20d6f62db/iec-61191-3-2017>

PRINTED BOARD ASSEMBLIES –

Part 3: Sectional specification – Requirements for through-hole mount soldered assemblies

1 Scope

This part of IEC 61191 prescribes requirements for lead and hole solder assemblies. The requirements pertain to those assemblies that totally use through-hole mounting technology (THT), or the THT portions of those assemblies that include other related technologies (i.e. surface mount, chip mounting, terminal mounting).

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 61191-1:2013, *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>

3.1

THT

through-hole technology

technology that permits an electrical connection of components to a conductive pattern by the use of plated or non-plated holes with annular rings in the mounting substrate

4 General requirements

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 Through-hole mounting of components

5.1 General

This clause covers the assembly of components with leads inserted into through-holes and soldered by machine and/or manual processes.

5.2 Placement accuracy

Placement accuracy for components inserted either manually or by machine methods shall be sufficient to insure that components are properly positioned after soldering. If suitable process controls are not in place to ensure compliance with this requirement and the intent of Annex A, the detailed requirements of Annex A shall be applicable.

5.3 Through-hole component requirements

5.3.1 Lead preforming

Part and component leads shall be pre-formed to the final configuration, excluding the final clinch or retention bend, before assembly or installation.

5.3.2 Tempered leads

When it is necessary to cut tempered leads, the governing work instructions shall specify cutting tools that do not impart detrimental shocks to internal connections of the components.

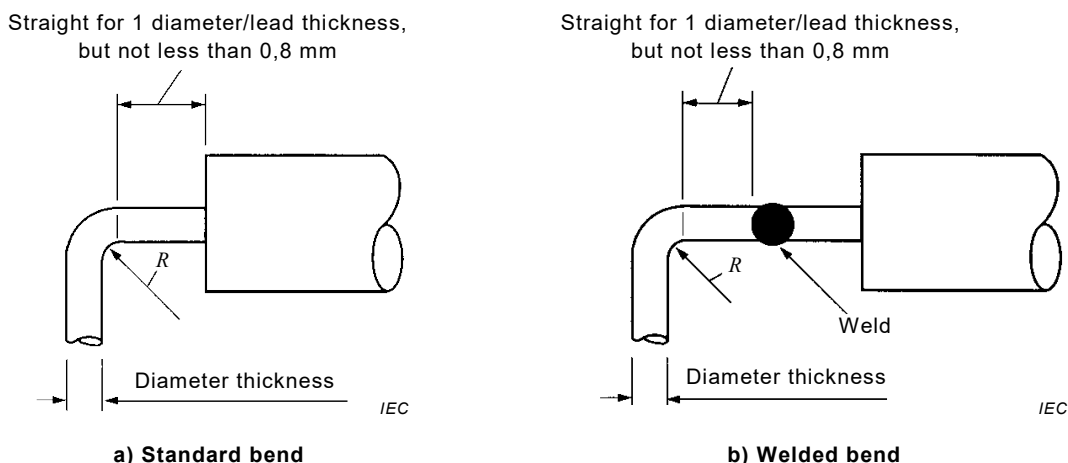
5.3.3 Lead forming requirements

Leads shall be formed in such a manner that the lead-to-body seal is not damaged or degraded. Leads shall extend at least one lead diameter or thickness but not less than 0,8 mm from the body or weld before the start of the bend radius (see Figure 1).

Exposed core metal is acceptable if reduction in the cross-sectional area does not exceed 10 % of the diameter of the lead. Occurrence of exposed core metal in the formed area of the lead shall be treated as a process indicator.

Measurement shall be made from the end of the part. The end of the part is defined to include any coating meniscus, solder seal, solder or weld bead, or any other extension.

The span for components mounted with a conventional lead form is 7,6 mm minimum, and 33 mm maximum.



Maximum lead diameter mm	Minimum bend radius <i>R</i>
Up to 0,8	1 diameter/thickness
0,8 to 1,2	1,5 diameters/thicknesses
Larger than 1,2	2 diameters/thicknesses

Figure 1 – Lead bends

5.3.4 Stress relief requirements

Component leads shall be formed in such a manner that the lead compliancy is not restricted in providing the natural stress relief of the lead material. Special lead formations are permitted to enhance stress relief properties.

5.3.5 Lead termination requirements

5.3.5.1 General

To ensure part retention during soldering operations, lead terminations in printed board plated through-holes shall be one of the following configurations: full clinch, partially clinched, or straight-through lead termination, as specified on the assembly drawing. In the event that nothing is specified, the manufacturer shall conform to the requirements in 5.3.5.2 to 5.3.5.10 as appropriate.

5.3.5.2 Clinched lead termination

Leads in unsupported holes and class C shall be clinched a minimum of 45°. The lead end should not extend beyond the edge of the land; however, if overhang does occur, the lead extension shall not violate minimum electrical spacing requirements. Leads formed of alloy 42 or comparable iron bearing alloys shall not be terminated with a full clinch.

NOTE Alloy 42 has the composition of Fe-Ni 41-Mn 0,8-Co 0,5.

5.3.5.3 Clinched lead orientation

When manually clinched, the clinched portion of the wire or lead should be directed along a printed conductor connected to the land. The leads on opposite ends or sides of a component should be directed in opposite directions. When automatically clinched, the orientation of the clinch relative to any conductor is optional. Manually formed clinches for non-axial leaded components should be directed radially from the centre of the component when the termination area array on the printed board is patterned for such radial orientation.