IEC 61191-2

Edition 3.0 2017-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Ensembles de cartes imprimées –
Partie 2: Spécification intermédiaire – Exigences relatives à l'assemblage par brasage pour montage en surface

IEC 61191-2:2017-05(en-fr)

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FOREWORD

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

This bilingual version (2019-09) corresponds to the monolingual English version, published in 2017-05.

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.

The French version of this standard has not been voted upon.

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- withdrawn,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.

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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.

5.2 Alignment requirements

Sufficient process control at all stages of design and assembly shall be in place to enable the post-soldering alignments and solder joint fillet controls specified in 6.3 to be achieved.

Relevant factors affecting the requirements include land and conductor design, component proximities, component and land solderability, solder paste/adhesive quantity and alignment and component placement accuracy.

5.3 Process control

If suitable process controls are not in place to ensure compliance with 5.2 and the intent of Annex A, the detailed requirements of Annex A shall be mandatory.

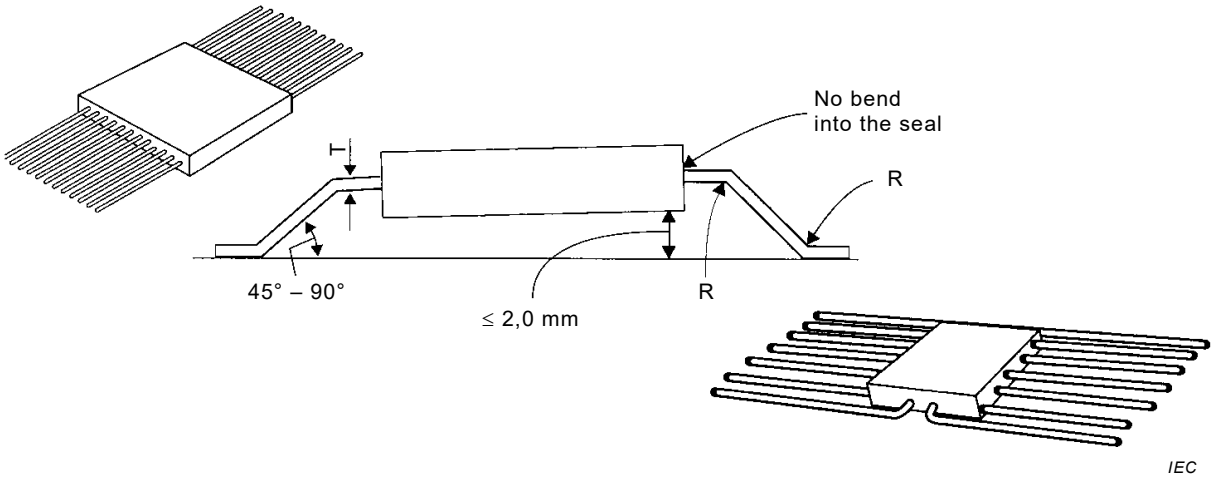
5.4 Surface mounted component requirements

The leads of lead surface mounted components shall be formed to their final configuration prior to mounting. Leads shall be formed in such a manner that the lead-to-body seal is not damaged or degraded and that they may be soldered into place by subsequent processes which do not result in residual stresses decreasing reliability. When the leads of dual-in-line packages, flatpacks, and other multilead devices become misaligned during processing or handling, they may be straightened to ensure parallelism and alignment prior to mounting, while maintaining the lead-to-body seal integrity.

5.5 Flatpack lead forming

5.5.1 General

Leads on opposite sides of surface mounted flatpacks shall be formed such that the non-parallelism between the base surface of the component and the surface of the printed board (i.e. component cant) is minimal. Component cant is permissible provided the final configuration does not exceed the maximum spacing limit of 2,0 mm (see Figure 1).



Key

R lead-bend radius

T nominal lead thickness

Figure 1 – Lead formation for surface mounted device

5.5.2 Surface mounted device lead bends

Leads shall be supported during forming to protect the lead-to-body seal. Bends shall not extend into the seal (see Figure 1). The lead-bend radius (R) shall be > 1 T (T = nominal lead

thickness). The angle of that part of the lead between the upper and lower bends in relation to the mounting land shall be 45° minimum and 90° maximum.

5.5.3 Surface mounted device lead deformation

Lead deformation (unintentional bending) may be allowed when

a) no evidence of a short circuit or potential short circuit exists,

b) lead-to-body seal or weld is not damaged by the deformation,

c) does not violate minimum electrical spacing requirement,

d) top of lead does not extend beyond the top of body; preformed stress loops may extend above the top of the body; however, stand-off height limit shall not be exceeded,

e) toe curl, if present on bends, shall not exceed two times the thickness of the lead (2 T),

f) coplanarity limits are not exceeded.

5.5.4 Flattened leads

Components with axial leads of round cross-section may be flattened (coined) for positive seating in surface mounting. If flattening is used, the flattened thickness shall be not less than 40 % of the original diameter. Flattened areas of leads shall be excluded from the 10 % deformation requirement in 6.5.3 of IEC 61191-1:2013.

Flattened leads on opposite sides of a surface mount part shall be formed such that the non-parallelism between the base surface of the component and the surface of the printed board (e.g. component cant) is minimal.

5.5.5 Dual-in-line packages (DIPs)

Dual-in-line packages may be surface mounted provided the leads are configured to meet the mounting requirements for surface mounted loaded parts. The lead preparation operation shall be performed using die forming/cutting systems. Hand forming and trimming of leads are prohibited.

5.5.6 Parts not configured for surface mounting

Flatpacks of the through-hole configuration, transistors, metal power packages, and other non-axial lead components shall not be surface mounted unless the leads are formed to meet the surface mounted device lead forming requirements. Such applications shall be agreed on between user and manufacturer.

5.6 Small devices with two terminations

5.6.1 General

The detailed requirements for mounting of small devices with two lead terminations are defined in 5.6.2 and 5.6.3.

5.6.2 Stack mounting

When part stacking is permitted by the assembly drawing, parts shall not bridge spacing between other parts or components such as terminals or other chip components.

5.6.3 Devices with external deposited elements

Components with electrical elements deposited on an external surface (such as chip resistors) shall be mounted with that surface facing away from the printed board or substrate.

5.7 Lead component body positioning

5.7.1 General

Parts mounted over protected surfaces and insulated parts that are positioned over circuitry or parts mounted over surfaces without exposed circuitry may be flush mounted (i.e. no stand-off height). Parts mounted over exposed circuitry shall have their leads formed to provide a minimum of 0,25 mm between the bottom of the component body and the exposed circuitry. The maximum clearance between the bottom of the leaded component body and the printed wiring surface shall not exceed 2,0 mm.

5.7.2 Axial-leaded components

The body of a surface-mounted axial-leaded component shall be spaced from the surface of the printed board at a maximum of 2,0 mm unless the component is mechanically attached to the substrate by adhesive or other means. Leads on opposite sides of surface mounted axial-leaded components shall be formed such that component cant (non-parallelism between the base surface of the mounted component and the surface of the printed board) is minimal and in no instance shall body cant result in non-conformance with maximum spacing limits.

5.7.3 Other components

TO-can devices, tall profile components (i.e. over 15 mm), transformers, and metal power packages may be surface mounted provided the parts are bonded or otherwise secured to the board in a manner which enables the part to withstand the end-item shock, vibration and environmental stresses.

5.8 Parts configured for butt lead mounting

Components designed for through hole (pin-in-hole) applications and modified for butt joint attachment, or stiff leaded dual-in-line packages may be butt mounted on level A and B products. Butt mounting is not permitted on level C products unless the component is designed for surface mounting. Components with solder-charged terminations designed for butt mounting may be acceptable for all classes. For other butt-mounted termination components acceptance criteria have to be agreed between the manufacturer and the user.

5.9 Non-conductive adhesive coverage limits

Non-conductive adhesive materials, when used for component mounting, shall not flow onto, or obscure, areas to be soldered or into vias or plated-through holes.

6 Acceptance requirements

6.1 General

Materials, processes, and procedures described and specified in IEC 61191-1 provide for soldered interconnections that are better than the minimum surface mount acceptance requirements in this clause. Processes and their control should be capable of producing product meeting or exceeding the acceptance criteria for defined product levels.

6.2 Control and corrective actions

The detailed requirements for acceptance, corrective action limits, control limit determination, and general assembly criteria described in IEC 61191-1 are a mandatory part of this standard. In addition 6.3 shall be met for all surface mount assembly and for connection acceptability.

6.3 Surface soldering of leads and terminations

6.3.1 General

Solder joints or terminations on components designed for surface mounting shall exhibit solder joints that meet the general descriptions of Clause 10 of IEC 61191-1:2013 with the specific measurements defined in 6.3.3 to 6.3.17 of this document. Some surface-mounted components will self-align during reflow soldering but a degree of misalignment is permitted to the extent specified. However, minimum design conductor spacing shall not be violated.

In 6.3.3 to 6.3.17, certain joint features are unspecified in size and the only requirement is that a properly wetted fillet to both lead/termination and lands be visible. Geometric dimensions not called out with any requirements are considered non-critical to the performance of the interconnection.

Surface-mounted joints formed to connector, socket, and other leads or terminations without mechanical support, subjected to stress from insertion and withdrawal of components or printed boards, shall meet the requirements of level C.

6.3.2 Solder fillet height and heel fillets

6.3.2.1 General

The height F of solder fillets, including heel fillets, as required in the following subclauses shall be judged by the distance the applied solder has risen up the joined surface. Figure 2 illustrates this measurement for joints of equal height but having different solder volume. In 6.3.3 to 6.3.12, for some lead configurations, the minimum acceptable fillet height criterion is referenced to the lead thickness T, or one half the thickness (0,5 T). When referenced to T, the height of the heel fillet to a formed lead shall be measured at the lowest point of the inside bend radius of the lead, as indicated by point A of Figure 2b (e.g. level C in Figures 3 to 5). When referenced to 0,5 T, the fillet may be 0,5 T lower (e.g. level B in Figures 3 to 5).

NOTE Subclause 6.3.3 provides an organization that combines the requirement paragraph, the appropriate figure and a dimensional table that describes the specific details.

6.3.2.2 Solder connection contours

A mounting technique shall be used to compensate for the coefficient of thermal expansion (CTE) mismatch of the part and board. This mounting technique shall be limited to part leads, specialized mounting devices, and normal solder connections. The use of specialized stand-offs mounted between the part and the land is permissible. Leadless components shall not be soldered into place using redundant interconnect wiring between the component castellation and the land.

Designs that use special solder connection contours as part of a CTE mismatch compensation system shall be identified on the approval assembly drawing. The mounting technique shall be capable of performing with a solder connection which meets the requirements of this document.

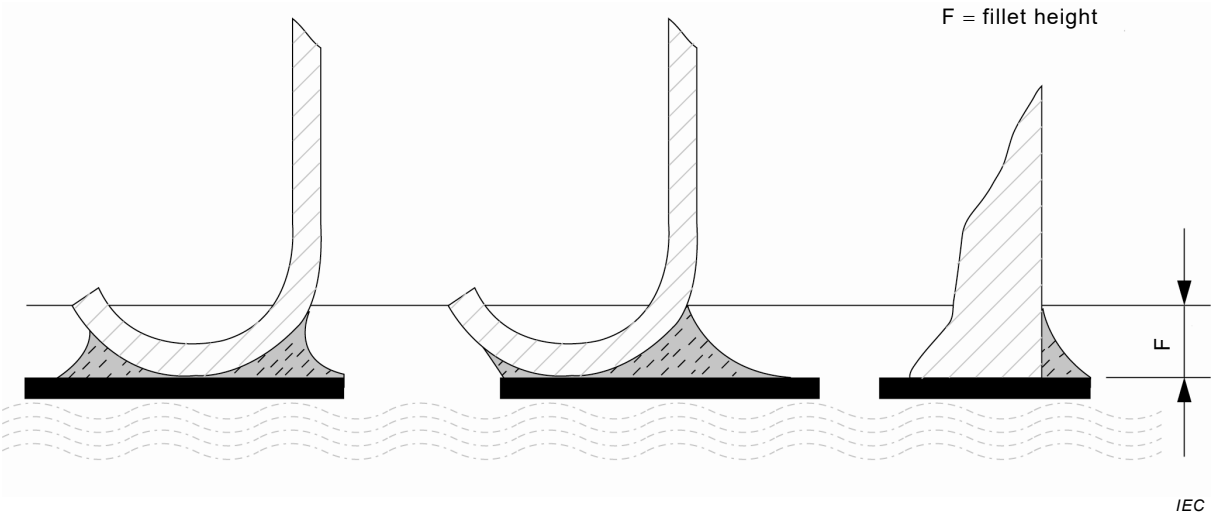
6.3.2.3 Surface mount device lead heel position

The heel of a leaded component shall not overhang the land.

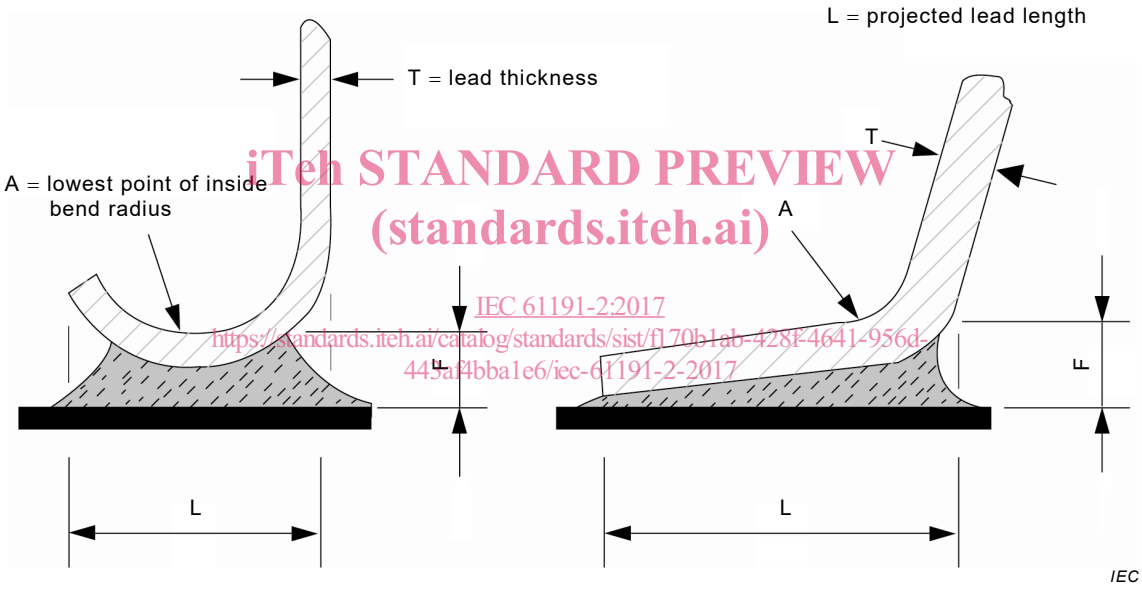
NOTE The heel begins where the lead starts to curve at the lead bend.

6.3.2.4 Break-away tie bars

Components (e.g. connectors and flexible circuits) which incorporate break-away tie bars in their design may be installed or soldered in place prior to removal of the tie bar. Exposed basis metal resulting from tie bar removal is permissible.



a) Fillet height



b) Fillet height referenced to lead thickness

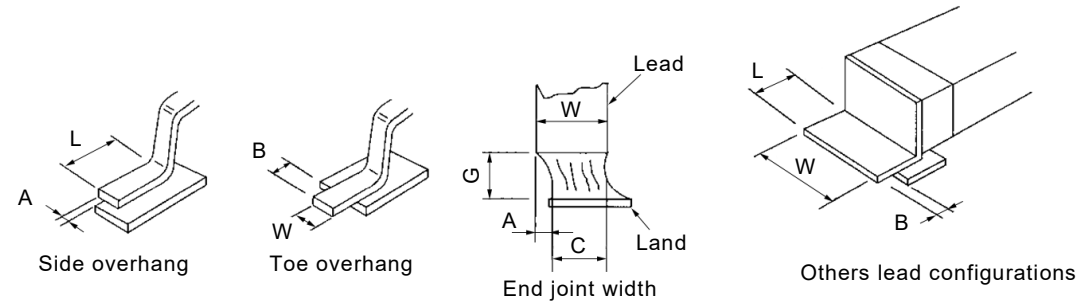
Key

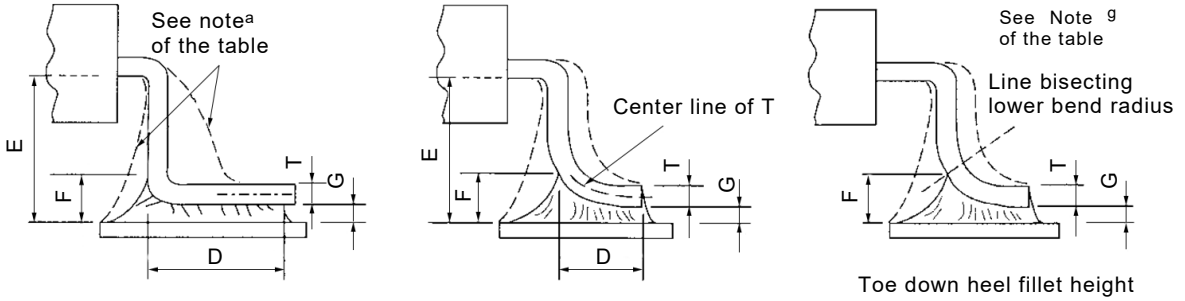
A lowest point of inside bend radius
F fillet height
L projected lead length
T lead thickness

Figure 2 – Fillet height

6.3.3 Flat ribbon L and gull-wing leads

Solder joints between substrate lands and flat ribbon leads formed into an L, and gull-wing shaped component leads of either stiff or flexible materials shall meet the alignment and solder fillet requirements of Figure 3 for each product level.





Dimensions in millimetres

Feature		Dimension	Level A	Level B	Level C
Maximum side overhang		A	½W or 0,5 mm,[d] whichever is less	½W or 0,5 mm,[d] whichever is less	¼W or 0,5 mm,[d] whichever is less
Maximum toe overhang		B	[d]	Not permitted when L < 3W [d]	Not permitted when L < 3W [d]
Minimum end joint width [c]		C	½W	½W	¾W
Minimum side joint length [b]	When L ≥ 3W	D	W or 0,5mm, whichever is less	3W or ¾L, whichever is longer	
	When L < 3W			L	
Maximum heel fillet height		E	[f]		
Minimum heel fillet height	T ≤ 0,4 mm	F	[e]	G + T	G + T [f]
	T > 0,4 mm			G + ½T	
Minimum solder thickness		G	[e]	[e]	[e]

[a] Solder fillets for levels A and B may extend through the top bend.

[b] Leads not having wettable sides or ends by design (such as leads stamped or sheared from prepared stock) are not required to have side or end fillets, but side overhang is not permitted (all levels).

[c, d] Shall not violate minimum design conductor spacing.

[e] Properly wetted fillet evident.

[f] Solder does not touch body or end seal.

[g] In case of toe down configuration, minimum fillet height F extends at least to the mid-point of the outside lead bend.

Figure 3 – Flat ribbon and gull-wing leads

6.3.4 Round or flattened (coined) leads

Joints formed to round or flattened (coined) leads shall meet the dimensional and fillet requirements of Figure 4 for each product level.