

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Printed boards –
Part 20: Printed circuit boards for high-brightness LEDs**

**Cartes imprimées –
Partie 20: Cartes de circuits imprimés destinées aux LED à haute luminosité**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2016 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
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 It also gives information on projects, replaced and withdrawn publications.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 15 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.

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.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

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 aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

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

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Printed boards –
Part 20: Printed circuit boards for high-brightness LEDs**

**Cartes imprimées –
Partie 20: Cartes de circuits imprimés destinées aux LED à haute luminosité**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.180

ISBN 978-2-8322-3152-4

**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.....	6
1 Scope.....	8
2 Normative references.....	8
3 Terms, definitions and abbreviations	8
3.1 Terms and definitions	8
3.2 Abbreviations	8
4 Classification and class of the printed circuit board for high-brightness LEDs.....	9
5 Design rules and allowance	10
5.1 Panel and board sizes	10
5.1.1 Board size	10
5.1.2 Allowance of dimensions	11
5.1.3 Perforation and slit.....	11
5.1.4 V-cut.....	12
5.2 Total board thickness	13
5.3 Holes.....	14
5.3.1 Insertion holes and vias	14
5.3.2 Datum hole	16
5.3.3 Assembly hole (a through-hole without wall plating)	16
5.4 Conductor	17
5.4.1 Width of conductor pattern and its allowance	17
5.4.2 Distance between conductors and its allowance.....	17
5.4.3 Thickness of the insulating layer.....	18
5.5 Printed contact.....	18
5.5.1 Allowance of the distance between the centers of two adjacent printed contacts.....	18
5.5.2 Allowance of the terminal width of printed contacts	19
5.5.3 Shift of the center of printed contacts on front and back sides of a board.....	19
5.6 Land pattern	20
5.6.1 Allowance of the distance between the centers of two lands.....	20
5.6.2 Allowance of the width of a land	20
5.6.3 Land diameter and its allowance for BGA/CSP.....	21
5.7 Fiducial mark and mark for component positioning	22
5.7.1 Typical form and size of the fiducial mark	22
5.7.2 Dimensional allowance of fiducial mark and component positioning mark	23
5.7.3 Position allowance of the component positioning mark	23
5.8 Interlayer connection – Copper plating.....	23
5.9 Quality	24
6.1 Gap between conductor and the wall of a component insertion hole or a via	24
6.2 Positional deviation between conductor layers of a multilayer board	24
6.3 Minimum land width.....	24
6.4 Surface treatment	25
6.4.1 Gold plating for printed contact.....	25
6.4.2 Other surface treatment	26
6.5 Defects of solder resist.....	26
6.6 Symbol mark.....	28
6.6.1 General	28

6.6.2	Conductor surface.....	28
6.6.3	Between conductors.....	28
6.6.4	Defects within insulating layers	29
6.6.5	Routing and drilling	30
6.6.6	Conductor pattern	30
6.7	Land	30
6.8	Land of a land pattern	31
6.9	Defects in a land for BGA/CSP mounting	32
6.10	Printed contact.....	32
7	Performance and test methods.....	34
7.1	Resistance of conductors	34
7.2	Current proof of conductor and plated through hole.....	35
7.3	Observation of component mountings and vias	36
7.3.1	Observation with standard conditions	36
7.3.2	Observation after thermal shock test	38
8	Marking, packaging and storage.....	39
8.1	Marking on a product.....	39
8.2	Marking on the package	39
8.3	Packaging and storage.....	40
8.3.1	Packaging.....	40
8.3.2	Storage.....	40
Annex A (informative) Classification and class of the PCB for high-brightness LEDs.....		41
Bibliography		46
Figure 1 – Example of a classification and its application.....		10
Figure 2 – Board arrangement in a panel.....		11
Figure 3 – Distances from the datum point to perforation and slit		12
Figure 4 – Distance from the datum point to the V-cut.....		12
Figure 5 – Allowance of position off-set of V-cuts on front and back surfaces		13
Figure 6 – PWB board with symbol mark, solder resist, copper foil and plating		13
Figure 7 – Positions of component insertion holes		15
Figure 8 – Distance between the wall of a hole and the board edge		15
Figure 9 – Wall of a hole and the minimum designed spacing to the inner conductor		16
Figure 10 – Width of finished conductor.....		17
Figure 11 – Distance between conductor and board edge		18
Figure 12 – Thickness of the insulating layer		18
Figure 13 – Distance between centers of terminals of printed contacts		19
Figure 14 – Terminal width of a printed contact		19
Figure 15 – Shift of the center of printed contacts on front and back sides of a board		20
Figure 16 – Land pattern.....		20
Figure 17 – Land width of a land pattern.....		21
Figure 18 – Land diameter of BGA/CSP formed of a conductor only.....		21
Figure 19 – Land diameter (d) of BGA/CSP formed at the opening of solder resist.....		22
Figure 20 – Examples of fiducial mark and component positioning mark.....		23
Figure 21 – Minimum land width.....		25

Figure 22 – Exposure of conductor.....	26
Figure 23 – Minimum land with caused by the shift of solder resist.....	27
Figure 24 – Overlap, smear and shift of solder resist	27
Figure 25 – Examples of smear or blur	28
Figure 26 – Example of measling	29
Figure 27 – Examples of crazing	29
Figure 28 – Conductor nicks.....	30
Figure 29 – Conductor residue	30
Figure 30 – Land	31
Figure 31 – Defects in a land of a land pattern.....	31
Figure 32 – Defects in BGA/CSP mounting lands.....	32
Figure 33 – Areas to be checked for defects of a printed contact.....	33
Figure 34 – Defects in a printed contact	33
Figure 35 – Relations between resistance and width, thickness and temperature of a conductor	35
Figure 36 – Relationship between current, conductor width and thickness and temperature rise	36
Figure 37 – Defect on a plating of a component hole	37
Figure 38 – Resin smear	38
Figure 39 – Corner crack	38
Figure 40 – Barrel crack.....	39
Figure 41 – Foil crack	39
Figure A.1 – Relation between thermal conductive parameter and heat transfer coefficient parameter	42
Table 1 – Application and classification	9
Table 2 – Panel dimensions	11
Table 3 – Allowance of dimension	11
Table 4 – Allowance of the distances from the datum point to perforation and slit.....	12
Table 5 – Allowance of the distance from the datum point to the center of the V-cut	13
Table 6 – Total thickness and its allowance	14
Table 7 – Allowance of holes for component insertion.....	14
Table 8 – Position allowance of component insertion holes	15
Table 9 – Distance between the wall of a hole and board edge	16
Table 10 – Minimum clearance between the wall of a hole and the inner layer conductor	16
Table 11 – Allowance of conductor width	17
Table 12 – Allowance of the distance between conductors	18
Table 13 – Allowance of terminal width of a printed contact	19
Table 14 – Allowance of terminal width of a printed contact	20
Table 15 – Allowance of the width of a land of a land pattern	21
Table 16 – Land diameter and its allowance for BGA/CSP	22
Table 17 – Allowance of the land diameter (d) of BGA/CSP formed at the opening of solder resist.....	22

Table 18 – Shapes and sizes of typical fiducial marks and component positioning marks	23
Table 19 – Minimum thickness of copper plating	23
Table 20 – Minimum thickness of copper plating	24
Table 21 – Minimum land width	27
Table 22 – Overlap, smear and shift of solder resist over a fool print.....	28
Table 23 – Allowance of the area of a defect, remaining width and protrusion of a land	31
Table 24 – Defect of a land of a land pattern	32
Table 25 – Defects in BGA/CSP mounting lands	32
Table 26 – Defects in a printed contact	34
Table 27 – Specification and test methods of resistance of conductors.....	34
Table 28 – Specification and test methods of current proof	35
Table 29 – Allowance in horizontal sectioning.....	38
Table A.1 – Relation between thermal conductive parameter and heat transfer coefficient parameter	42
Table A.2 – Related test methods.....	43

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRINTED BOARDS –

Part 20: Printed circuit boards for high-brightness LEDs

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 62326-20 has been prepared by IEC technical committee 91: Electronics assembly technology.

This first edition cancels and replaces the IEC/PAS 62326-20 published in 2011, and constitutes a technical revision.

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

- a) this edition focuses on the technical content of the printed circuit board for high-brightness LEDs;
- b) the figures related to the printed circuit board for high-brightness LEDs have been refined.

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

FDIS	Report on voting
91/1311/FDIS	91/1330/RVD

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

A list of all parts in the IEC 62326 series, published under the general title *Printed boards*, can be found on the IEC website.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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 before print this document using a colour printer.

PRINTED BOARDS –

Part 20: Printed circuit boards for high-brightness LEDs

1 Scope

This part of IEC 62326 specifies the properties of the printed circuit board (hereafter described as PCB) for high-brightness LEDs. Many aspects of the PCB for high-brightness LEDs are identical with those of ordinary PCBs, therefore, some aspects of this standard also describe general aspects.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 61189-3:2007, *Test methods for electrical material, printed boards and other interconnection structures and assemblies – Part 3: Test methods for interconnection structures (printed boards)*

IEC 61249-2-6, *Materials for printed boards and other interconnecting structures – Part 2-6: Reinforced base materials, clad and unclad – Brominated epoxide non-woven/woven E-glass reinforced laminated sheets of defined flammability (vertical burning test), copper-clad*

IEC 61249-2-7, *Materials for printed boards and other interconnecting structures – Part 2-7: Reinforced base materials clad and unclad – Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

IEC 62878-1-1, *Device embedded substrate – Part 1-1: Generic specification – Test methods*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.2 Abbreviations

ABUS	As Agreed Between User and Supplier
BGA	Ball Grid Array
CCL	Copper Clad Laminate
COB	Chip On Board
CSP	Chip size package
HID	High Intensity Discharge
LED	Light Emitting Diode
PCB	Printed Circuit Board