

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Packaging of components for automatic handling –
Part 2: Tape packaging of components with unidirectional leads on continuous
tapes

IEC 60286-2:2015
Emballage de composants pour opérations automatisées –
Partie 2: Emballage des composants à sorties unilatérales en bandes continues



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 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 more than 30 000 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

More than 60 000 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 plus de 30 000 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

Plus de 60 000 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

**Packaging of components for automatic handling –
Part 2: Tape packaging of components with unidirectional leads on continuous
tapes**

**Emballage de composants pour opérations automatisées –
Partie 2: Emballage des composants à sorties unilatérales en bandes continues**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.020; 31.240

ISBN 978-2-8322-2595-0

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

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references.....	7
3 Terms, definitions and symbols.....	7
3.1 Terms and definitions.....	7
3.2 Symbols.....	10
4 Dimensions.....	13
4.1 Tape width dimensions (W , W_0 , W_1 , W_2).....	13
4.1.1 Tape width (W).....	13
4.1.2 Hold-down tape width (W_0).....	13
4.1.3 Distance between the upper edges of the carrier tape and the abscissa (W_1).....	13
4.1.4 Distance between the upper edges of the carrier tape and the hold-down tape (W_2).....	13
4.2 Components and sprocket hole pitches (P , P_0 , P_1 , P_2 , D_0).....	13
4.2.1 General.....	13
4.2.2 Pitch between two consecutive mutual components (P).....	13
4.2.3 Pitch between two consecutive sprocket holes (P_0).....	13
4.2.4 Distance between the ordinate and the first lead of the component on the drawer side (for components with two leads) (P_1).....	14
4.2.5 Distance between the ordinate and the center lead of the component on the drawer side (for components with three leads) (P_2).....	14
4.2.6 Sprocket hole diameter (D_0).....	14
4.3 Dimensions for component position relative to the abscissa (H , H_0 , H_1 , H_2 , H_3).....	14
4.3.1 Distance between the abscissa and the bottom plane of the component body (H).....	14
4.3.2 Distance between the abscissa and the reference plane of components with crimped leads (H_0).....	14
4.3.3 Distance between the abscissa and the top of the body of the components (H_1).....	14
4.3.4 Distance between the abscissa and the tip of the short terminal without tape (H_2).....	14
4.3.5 Distance between the bottom of the component and the tip of the short terminal without tape (H_3).....	14
4.4 Lead terminal dimensions (d , d_1 , F , F_1 , F_2 , L , K) and tape thickness (T , T_1).....	15
4.4.1 Dimensions and tolerances of lead spacing for two lead components (F) and for three lead components (F_1 , F_2).....	15
4.4.2 Lead terminal diameter (d , d_1).....	15
4.4.3 Tape thickness (T , T_1).....	15
4.4.4 Maximum permissible protrusion of the ends of the leads (L).....	15
4.4.5 Distance between the lead terminal and the short terminal without tape (K).....	15
4.5 Maximum permissible deviation of taped component dimensions.....	16
4.5.1 Maximum permissible deviation of taped component dimensions (Δh , Δp , ΔP_1).....	16
5 Taping.....	16
5.1 Taping dimensions.....	16
5.2 Splices.....	16

5.3	Tape leader and trailer	17
6	Tape	17
6.1	Polarization direction on tape	17
6.2	Kinks or bends on tape	17
6.3	Adhesion to tape and extraction force	17
6.4	Tape breaking force	18
6.5	Tape material	18
6.6	Hold-down tape	18
6.7	Missing components	18
7	Packing	19
7.1	General	19
7.2	Reel dimensions	19
7.2.1	Component tape reeling	20
7.2.2	Components protection	20
7.2.3	Reel filling	21
7.3	Maximum dimensions of the fan-fold container	21
7.4	Recycling	21
7.5	Marking	21
Annex A	(informative) Dimensions for two leads	22
A.1	Dimensions for two formed leads, sprocket hole between parts	22
A.2	Dimensions for two formed leads, sprocket hole between leads	24
A.3	Dimensions for two straight leads, sprocket hole between parts	26
A.4	Dimensions for two straight leads, sprocket hole between leads	28
Annex B	(informative) Dimensions for three leads	30
B.1	Dimensions for three formed leads, sprocket hole between parts	30
B.2	Dimensions for three formed leads, sprocket hole between leads	32
Bibliography	34
Figure 1	– Short terminal without tape	8
Figure 2	– Crimp	8
Figure 3	– Abscissa, ordinate, seating plane and reference plane	9
Figure 4	– Symbol references of tape and taped components dimensions	11
Figure 5	– Symbol references of reel dimensions	12
Figure 6	– Symbol references of fan-fold container dimensions	12
Figure 7	– Position of short terminal without tape	16
Figure 8	– Leader and trailer of tape	17
Figure 9	– Pull strength from taping	18
Figure 10	– Missing components	19
Figure 11	– Reeling	20
Figure A.1	– Symbol references for two formed leads, sprocket hole between parts	22
Figure A.2	– Symbol references for two formed leads, sprocket hole between leads	24
Figure A.3	– Symbol references for two straight leads, sprocket hole between parts	26
Figure A.4	– Symbol references for two straight leads, sprocket hole between leads	28
Figure B.1	– Symbol references for three formed leads, sprocket hole between parts	30
Figure B.2	– Symbol references for three formed leads, sprocket hole between leads	32

Table 1 – List of symbols for tape and taped components	10
Table 2 – List of symbols used for packing taped components	12
Table 3 – Reel dimensions	20
Table 4 – Maximum outer dimensions for a fan-fold arrangement	21
Table A.1 – Dimensions for two formed leads, sprocket hole between parts	23
Table A.2 – Dimensions for two formed leads, sprocket hole between leads	25
Table A.3 – Dimensions for two straight leads, sprocket hole between parts	27
Table A.4 – Dimensions for two straight leads, sprocket hole between leads	29
Table B.1 – Dimensions for three formed leads, sprocket hole between parts	31
Table B.2 – Dimensions for three formed leads, sprocket hole between leads	33

iTeh STANDARD PREVIEW (standards.iteh.ai)

IEC 60286-2:2015

<https://standards.iteh.ai/catalog/standards/sist/2759af3b-5637-47a4-8b82-feb3641f887b/iec-60286-2-2015>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –**Part 2: Tape packaging of components with
unidirectional leads on continuous tapes**

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 60286-2 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This fourth edition cancels and replaces the third edition, published in 2008, and constitutes a technical revision.

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

- A complete revision of the structure and reworked layout.
- A two page overview containing a clear overview of all symbols and references.
- Addition of annexes of known radial tape formats.
- Improved figures.

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

FDIS	Report on voting
40/2343/FDIS	40/2374/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.

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

A list of all parts in the IEC 60286 series, published under the general title *Packaging of components for automatic handling*, can be found on the IEC website.

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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

IEC 60286-2:2015

<https://standards.iteh.ai/catalog/standards/sist/2759af3b-5637-47a4-8b82-feb3641f887b/iec-60286-2-2015>

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

Part 2: Tape packaging of components with unidirectional leads on continuous tapes

1 Scope

This part of IEC 60286 applies to the tape packaging of components with two or more unidirectional leads for use in electronic equipment. In general, the tape is applied to the component leads.

It covers requirements for taping techniques used with equipment for automatic handling, pre-forming of leads, insertion and other operations and includes only those dimensions which are essential to the taping of components intended for the above-mentioned purposes.

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 60097:1991, *Grid systems for printed circuits*

[IEC 60286-2:2015](https://standards.iteh.ai/catalog/standards/sist/2759af3b-5637-47a4-8b82-feb3641f887b/iec-60286-2-2015)

IEC 60301, *Preferred diameters of wire terminations of capacitors and resistors*

[http://standards.iteh.ai/catalog/standards/sist/2759af3b-5637-47a4-8b82-feb3641f887b/iec-60286-2-2015](https://standards.iteh.ai/catalog/standards/sist/2759af3b-5637-47a4-8b82-feb3641f887b/iec-60286-2-2015)

3 Terms, definitions and symbols

For the purpose of this document, the following terms, definitions and symbols apply.

3.1 Terms and definitions

3.1.1

package

product made of any material of any nature to be used in containment, protection, structured alignment for automatic assembly, handling and delivery

3.1.2

short terminal without tape

terminal which is not held between carrier tape and cover tape

Note 1 to entry: See Figure 1.

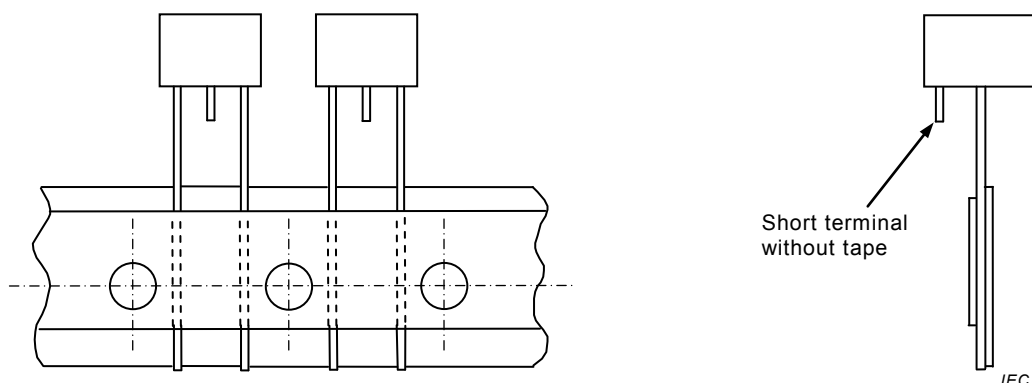


Figure 1 – Short terminal without tape

3.1.3 crimp cinch

purposely formed angular deformation, starting at the reference plane, in such a way that the component bottom side does not touch the top surface of the printed circuit board after insertion and therefore acts as a 'stand-off'

Note 1 to entry: The formed crimp is available in different forms, see Figure 2.

Note 2 to entry: A crimp acts as a 'stand-off' tool.

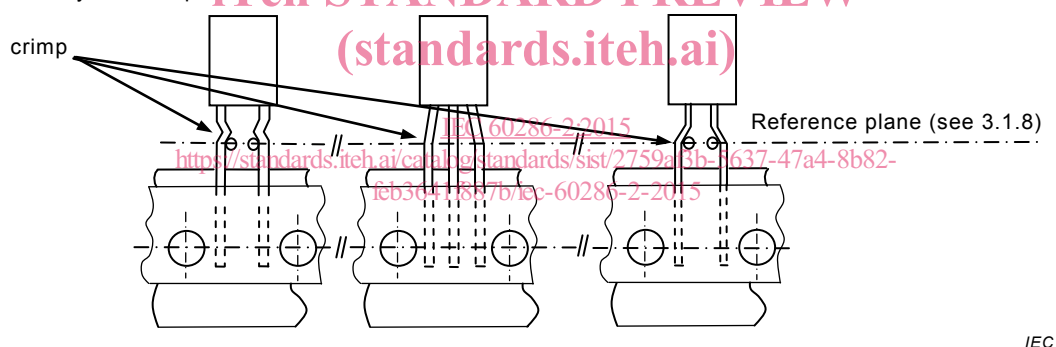


Figure 2 – Crimp

3.1.4 ordinate

straight line, perpendicular to the abscissa through the centre of the closest sprocket hole that follows the component to be checked

See Figure 3.

3.1.5 abscissa

straight line, through the centres of the sprocket holes in the direction of unreeling

See Figure 3.

3.1.6 seating plane

<components with straight leads> bottom of the component body, including any projections which support the component on the printed board

See Figure 3.

Note 1 to entry: The line goes parallel to the reference abscissa through the bottom point nearest to the tape.

Note 2 to entry: A method for determining the seating plane is given in IEC 60717.

Note 3 to entry: For definition of the reference plane, see 3.1.8, for definition of crimped leads, see 3.1.3.

3.1.7

seating plane

<components with crimped (or performed) leads> plane that changes depending on the profile of the crimp, the diameter of the leads and the hole size in the printed board

See Figure 3.

Note 1 to entry: In these components, instead of a seating plane, a reference plane is defined, for components with crimped leads only.

Note 2 to entry: A method for determining the seating plane is given in IEC 60717.

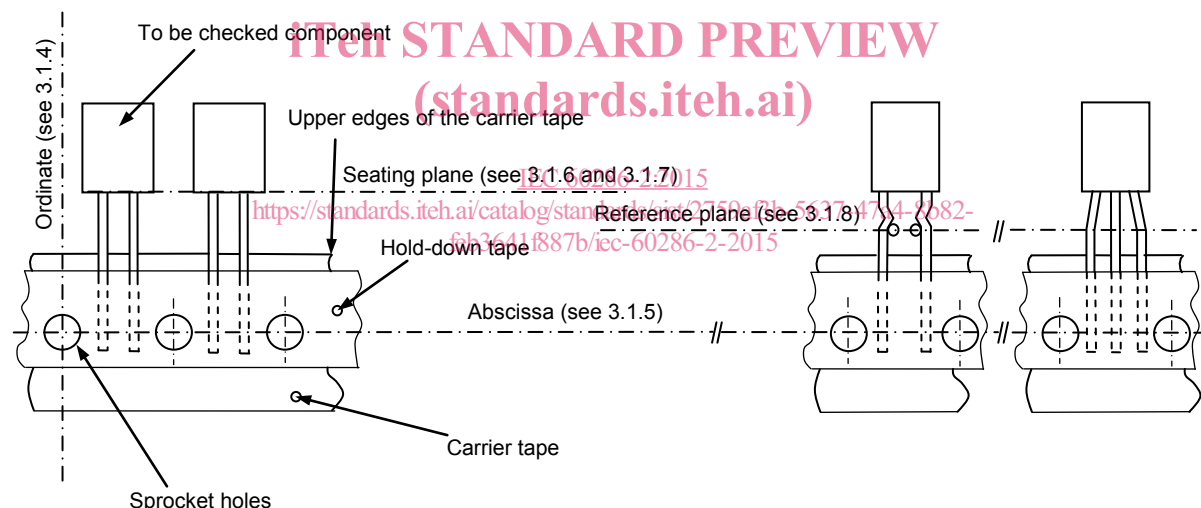
Note 3 to entry: For definition of the reference plane, see 3.1.8, for definition of crimped leads, see 3.1.3.

3.1.8

reference plane

line parallel to the abscissa through the lowest centre of the radius of curvature of the bending of the crimp

Note 1 to entry: See Figure 3.



IEC

Figure 3 – Abscissa, ordinate, seating plane and reference plane

3.2 Symbols

The symbols used for tape and taped components are listed in Table 1 and Table 2. The use of these symbols is exemplified in Figure 4, Figure 5 and Figure 6.

Table 1 – List of symbols for tape and taped components

Symbols	Definition of symbols	Figure 4, sketch	Subclause
d	Lead terminal diameter	E	4.4.2
d_1	Diameter of short terminal without tape	F	4.4.2
D_0	Sprocket hole diameter	E	4.2.6
F	Lead spacing	D	4.4.1
F_1	Lead spacing between left lead and centre lead of the components with three leads	D	4.4.1
F_2	Lead spacing between right lead and centre lead of the components with three leads	D	4.4.1
H	Distance between the abscissa and the bottom plane of the component body	A, B, C, D	4.3.1
H_0	Distance between the abscissa and the reference plane of components with crimped leads (for crimped leads only)	D	4.3.2
H_1	Distance between the abscissa and the top of the body of the components	A, B, C, D	4.3.3
H_2	Distance between the abscissa and tip of short terminal without tape	E	4.3.4
H_3	Distance between the bottom of components and tip of short terminal without tape	E	4.3.5
Δh	Maximum lateral deviation of the component body vertical to the tape plane	H	4.5.1
K	Distance between the lead terminal and the short terminal without tape	F	4.4.5
L	Protrusion beyond the lower side of the carrier tape	E	4.4.4
P	Pitch of the mutual components	A, B, C	4.2.2
P_0	Pitch of the sprocket holes	A, B, C, D	4.2.3
P_1	Distance between ordinate and first lead terminal of the drawer side	A, B, C, D	4.2.4
P_2	Distance between the ordinate and the centre lead of the component on the drawer side	D	4.2.5
Δp	Maximum deviation of the component body in the tape plane	G	4.5.1
ΔP_1	Maximum deviation of the component lead in the seating plane	C	4.5.1
T	Thickness of the carrier tape and the hold-down tape	I	4.4.3
T_1	Total thickness of the carrier tape, the hold-down tape and diameter of the lead	I	4.4.3
W	Carrier tape width	D	4.1.1
W_0	Hold-down tape width	D	4.1.2
W_1	Distance between the upper edges of the carrier tape and the abscissa (centre of the sprocket hole)	D	4.1.3
W_2	Distance between the upper edges of the carrier tape and the hold-down tape	D	4.1.4

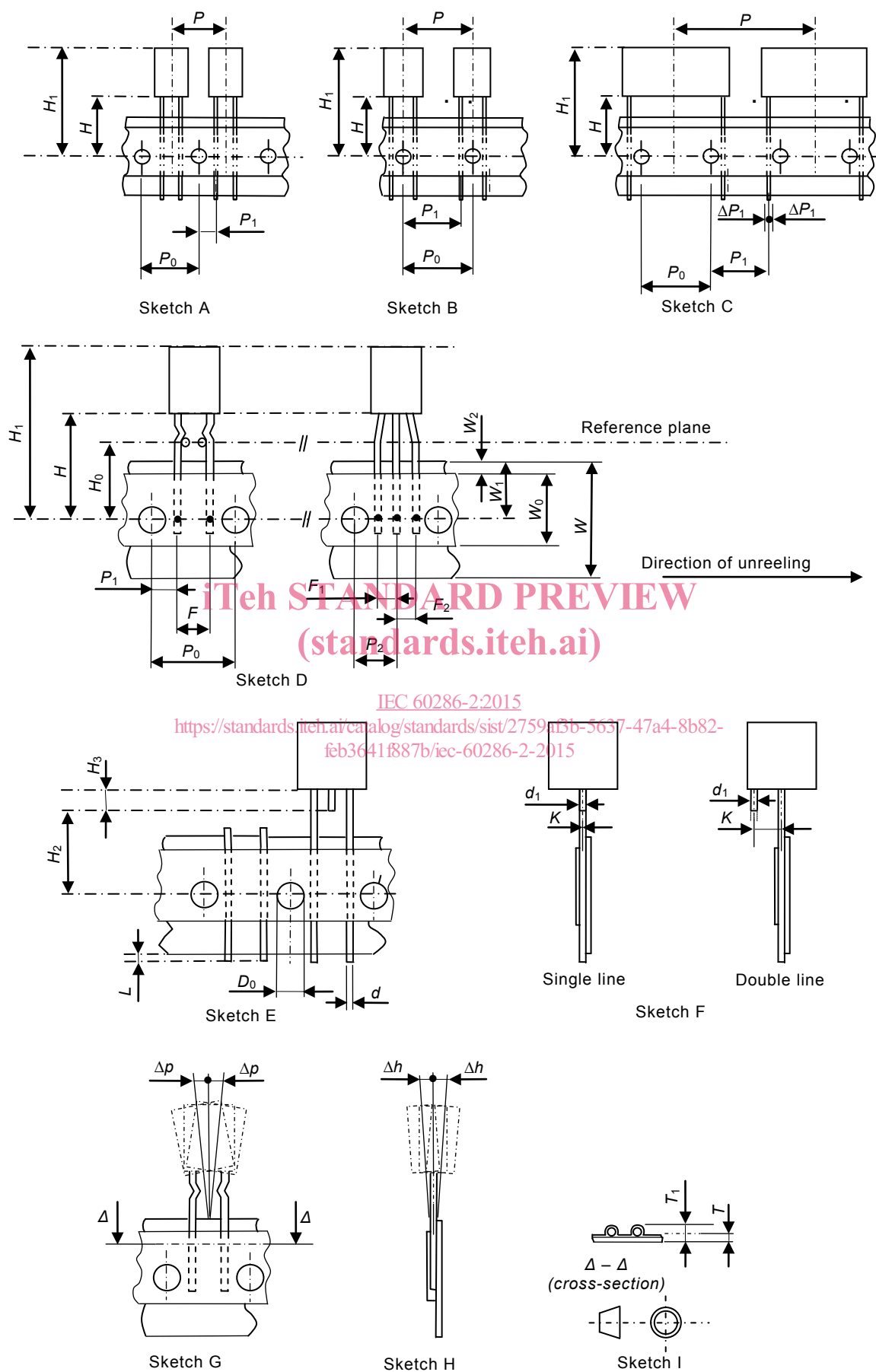


Figure 4 – Symbol references of tape and taped components dimensions

Table 2 – List of symbols used for packing taped components

Symbols	Definition of symbols	Figure reference	Subclause
A	Reel diameter	Figure 5	7.2
C	Arbour hole diameter	Figure 5	7.2
N	Hub diameter	Figure 5	7.2
W_3	Width between flanges, measured at hub	Figure 5	7.2
W_4	Total reel width, measured at hub	Figure 5	7.2
X	Width of fan-fold container	Figure 6	7.3
Y	Length of fan-fold container	Figure 6	7.3
Z	Height of fan-fold container	Figure 6	7.3

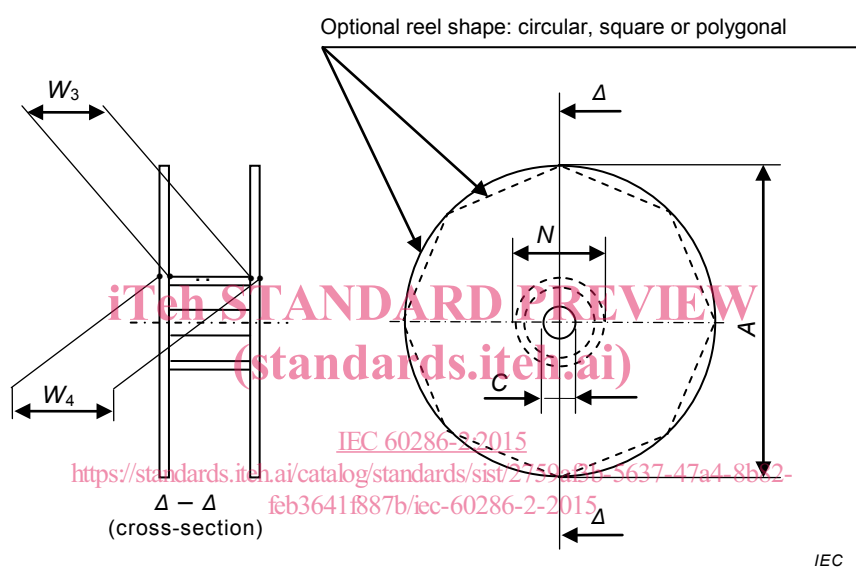


Figure 5 – Symbol references of reel dimensions

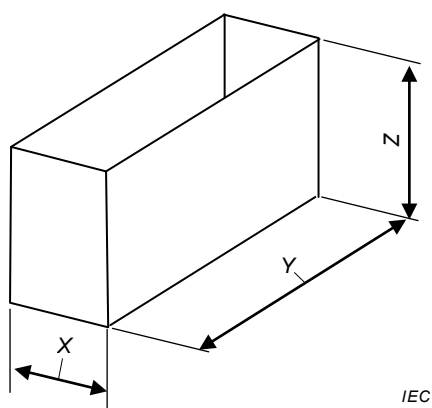


Figure 6 – Symbol references of fan-fold container dimensions

4 Dimensions

For references, see Figure 4 and Table 1.

4.1 Tape width dimensions (W , W_0 , W_1 , W_2)

The following clauses describe the dimensions related to tape width.

4.1.1 Tape width (W)

See Figure 4, sketch D

- Carrier tape width W $W = 18^{+1,0}_{-0,5}$ mm

4.1.2 Hold-down tape width (W_0)

See Figure 4, sketch D

This dimension is governed by the retention of the components in the tape. The hold-down tape shall not protrude beyond the carrier tape.

- Hold-down tape width W_0 (see Annex A and Annex B)

4.1.3 Distance between the upper edges of the carrier tape and the abscissa (W_1)

See Figure 4, sketch D

- Position of sprocket hole W_1 $W_1 = 9,0^{+0,75}_{-0,5}$ mm

4.1.4 Distance between the upper edges of the carrier tape and the hold-down tape (W_2)

See Figure 4, sketch D

- Distance W_2 $W_2 = 3,0$ mm max.

4.2 Components and sprocket hole pitches (P , P_0 , P_1 , P_2 , D_0)

4.2.1 General

The following subclauses describe the dimensions common to the taped component in relation to its location in the tape and the mutual distance between components.

The grid is defined as lead spacing $e = 2,5$ mm shall be used (see IEC 60097).

NOTE 1 Components with a lead spacing of $F = 3 \times e$ may be delivered with the sprocket holes arranged between the leads of the component (see Figure 4, sketch B).

NOTE 2 Components with a lead spacing of $F = 8 \times e$ to $11 \times e$ may be delivered with one or two sprocket holes arranged between the leads of the component (see Figure 4, sketch B and C).

4.2.2 Pitch between two consecutive mutual components (P)

See Figure 4, sketch A, B, and C

- Pitch P (see Annex A and Annex B)

4.2.3 Pitch between two consecutive sprocket holes (P_0)

See Figure 4, sketch A, B, C and D

- Pitch P_0 (see Annex A and Annex B)