

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Packaging of components for automatic handling –
Part 3: Packaging of surface mount components on continuous tapes**

**Emballage de composants pour opérations automatisées –
Partie 3: Emballage des composants pour montage en surface en bandes
continues**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2013 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 la CEI ou du Comité national de la CEI du pays du demandeur.
Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI 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.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you 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It also gives information on projects, replaced and withdrawn publications.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 on-line 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 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

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 la CEI

La Commission Electrotechnique Internationale (CEI) 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 CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente. un corrigendum ou amendement peut avoir été publié.

Liens utiles:

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

La recherche avancée vous permet de trouver des publications CEI 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.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. 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 au monde 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 les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

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 3: Packaging of surface mount components on continuous tapes**

**Emballage de composants pour opérations automatisées –
Partie 3: Emballage des composants pour montage en surface en bandes
continues**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

W

ICS 31.020; 31.240

ISBN 978-2-83220-819-9

**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.....	5
INTRODUCTION.....	7
1 General.....	8
1.1 Scope.....	8
1.2 Normative references.....	8
2 Terms and definitions.....	8
3 Structure of the specification.....	10
4 Dimensional requirements for taping.....	10
4.1 Component cavity positioning requirements.....	10
4.1.1 Requirements for types 1a, 1b, 2a, 2b and 3.....	10
4.1.2 Requirements for types 4.....	10
4.2 Component cavity dimension requirements (tape types 1a, 1b, 2a, 2b and 3).....	11
4.3 Type 1a – Punched carrier tape, with top and bottom cover tape (tape widths: 8 mm and 12 mm).....	12
4.4 Type 1b – Pressed carrier tape, with top cover tape (tape width: 8 mm).....	14
4.5 Type 2a – Blister carrier tape, with single round sprocket holes and tape pitches down to 2 mm (tape widths: 8 mm, 12 mm, 16 mm and 24 mm).....	16
4.6 Type 2b – Blister carrier tape, with single round sprocket holes and with 1mm tape pitch (tape widths: 4 mm).....	18
4.7 Type 3 – Blister carrier tape, with double sprocket holes (32 mm to 200 mm).....	20
4.8 Type 4 – Adhesive-backed punched plastic carrier tape for singulated bare die and other surface mount components (8 mm, 12 mm, 16 mm and 24 mm).....	22
5 Polarity and orientation requirements of components in the tape.....	25
5.1 Requirements for all tape types.....	25
5.2 Specific requirements for type 1a.....	25
5.3 Specific requirements for type 4.....	25
6 Carrier tape requirements.....	25
6.1 Taping materials.....	25
6.2 Minimum bending radius (for all types).....	26
6.3 Camber.....	26
7 Cover tape requirements (for type 1a, 1b, 2a, 2b and 3).....	27
8 Component taping and additional tape requirements.....	28
8.1 All types.....	28
8.2 Specific requirements for type 1b.....	28
8.3 Specific tape requirements for type 2b.....	28
8.4 Specific requirement for type 4.....	28
8.4.1 General.....	28
8.4.2 Coordinate system.....	29
8.4.3 Component positioning and lateral displacement (see Figures 19 and 23).....	30
8.5 Specific requirements for tapes containing die products.....	31
8.5.1 General.....	31
8.5.2 Tape design for tapes containing die products.....	31
8.5.3 Cleanliness.....	31
8.5.4 Die lateral movement (Types 1a, 2a and 2b).....	32
9 Reel requirements.....	32
9.1.1 General.....	32

9.1.2	Reel dimensions related to tape (see Figure 24 and Table 23)	32
9.1.3	Reel hole dimensions (see Figure 25 and Table 24)	34
9.2	Marking	34
10	Tape reeling requirements	35
10.1	All types	35
10.2	Specific requirements for type 1a	35
10.3	Specific requirements for type 4	35
10.4	Leader and trailer tape (see Figure 27)	36
10.4.1	Leader	36
10.4.2	Trailer	36
10.5	Recycling	36
10.6	Missing components	36
Annex A (normative)	Recommended measuring methods for type 1b	37
Bibliography		39
Figure 1	– Sectional view of component cavity (type 1b)	9
Figure 2	– 8 mm and 12 mm punched carrier-tape dimensions (4 mm cavity pitch)	12
Figure 3	– Illustration of 2 mm and 1 mm cavity pitch and maximum pocket offset	12
Figure 4	– Maximum component tilt, rotation and lateral movement	12
Figure 5	– Dimensions ($P_0 = 4 \text{ mm}/P_1 = 2 \text{ mm}$) and ($P_0 = 4 \text{ mm}/P_1 = 1 \text{ mm}$)	14
Figure 6	– Illustration of 2 mm and 1 mm cavity pitch and maximum pocket offset	14
Figure 7	– Maximum component tilt, rotation and lateral movement	14
Figure 8	– Blister carrier tape dimensions (8 mm, 12 mm, 16 mm and 24 mm)	16
Figure 9	– Illustration of 2 mm cavity pitch and pocket offset	16
Figure 10	– Maximum component tilt, rotation and lateral movement	16
Figure 11	– Type 2b carrier tape	18
Figure 12	– Maximum pocket offset	18
Figure 13	– Maximum component tilt, rotation and lateral movement	18
Figure 14	– Blister carrier tape	20
Figure 15	– Elongated sprocket hole skew	20
Figure 16	– Maximum component tilt, rotation and lateral movement	20
Figure 17	– Adhesive-backed punched carrier-tape dimensions (4 mm compartment pitch)	23
Figure 18	– Illustration of 2 mm compartment pitch	23
Figure 19	– Maximum component planar rotation and lateral displacement	23
Figure 20	– Bending radius	26
Figure 21	– Camber (top view)	27
Figure 22	– Type 4 coordinate system	30
Figure 23	– Component clearance and positioning method	31
Figure 24	– Reel	32
Figure 25	– Reel hole presentation	34
Figure 26	– Tape reeling and label area on the reel	35
Figure 27	– Leader and trailer	36
Figure A.1	– Carrier tape thickness measurement points	37

Figure A.2 – Cavity cross-section.....	37
Figure A.3 – Cavity depth dimension.....	38
Table 1 – component size codes.....	9
Table 2 – Constant dimensions of 8 mm and 12 mm punched carrier tape.....	13
Table 3 – Variable dimensions of 8 mm and 12 mm punched carrier tape.....	13
Table 4 – Component tilt, planar rotation and lateral movement.....	13
Table 5 – Constant dimensions of 8 mm pressed carrier tape.....	15
Table 6 – Variable dimensions of 8 mm pressed carrier tape.....	15
Table 7 – Component tilt, planar rotation and lateral movement.....	15
Table 8 – Constant dimensions of 8 mm to 24 mm blister carrier tape.....	17
Table 9 – Variable dimensions of 8 mm to 24 mm blister carrier tape.....	17
Table 10 – Component tilt, rotation and lateral movement.....	17
Table 11 – Constant dimensions of 4 mm carrier tape.....	19
Table 12 – Variable dimensions of 4 mm carrier tape.....	19
Table 13 – Component tilt, planar rotation and lateral movements.....	19
Table 14 – Constant dimensions of 32 mm to 200 mm blister carrier tape.....	21
Table 15 – Variable dimensions of 32 mm to 200 mm blister carrier tape.....	21
Table 16 – Component tilt, planar rotation and lateral movements.....	21
Table 17 – Dimensions of adhesive backed punched carrier tape.....	24
Table 18 – Variable dimensions of adhesive-backed punched carrier tape.....	24
Table 19 – Component planar rotation and lateral displacement.....	24
Table 20 – Minimum bending radius.....	26
Table 21 – Peel force.....	27
Table 22 – Absolute referencing data for component target position.....	30
Table 23 – Reel dimensions.....	33
Table 24 – Reel hole dimensions.....	34

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –**Part 3: Packaging of surface mount components
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 60286-3 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This fifth edition cancels and replaces the fourth edition, published in 2007, as well as IEC 60286-3-1, published in 2009 and IEC 60286-3-2, published in 2009. It constitutes a full layout revision. In addition, this edition includes the following significant technical changes with respect to the previous edition:

- a) integration of IEC 60286-3-1:2009 as type 1b (Packaging of surface mount components on continuous pressed carrier tapes);
- b) integration of IEC 60286-3-2:2009 as type 2b (Packaging of surface mount components on blister carrier tapes 4 mm in width).

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

FDIS	Report on voting
40/2200/FDIS	40/2233/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.

The list of all the parts of the IEC 60286 series, 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 web site 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)

<https://standards.iteh.ai/catalog/standards/sist/57f6375-db08-45ef-81f1-61bd73b7ab8/iec-60286-3-2013>

<https://standards.iteh.ai/catalog/standards/sist/57f6375-db08-45ef-81f1-61bd73b7ab8/iec-60286-3-2013>

INTRODUCTION

Tape packaging meets the requirements of automatic component placement machines and also covers the use of tape packaging for components and singulated dies for test purposes and other operations.

Witholdrawn

iTeh STANDARD PREVIEW
(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/57f6375-db08-45ef-81f1-61bd73b7ab8/iec-60286-3-2013>

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

Part 3: Packaging of surface mount components on continuous tapes

1 General

1.1 Scope

This part of IEC 60286 is applicable to the tape packaging of electronic components without leads or with lead stumps, intended to be connected to electronic circuits. It includes only those dimensions that are essential for the taping of components intended for the above-mentioned purposes.

This standard also includes requirements related to the packaging of singulated die products including bare die and bumped die (flip chips).

1.2 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 60191-2, *Mechanical standardization of semiconductor devices – Part 2: Dimensions*

IEC 61340-5-1, *Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements*

IEC/TR 61340-5-2, *Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide*

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply. Definitions apply to all tape types, unless specifically mentioned.

2.1 components

unless specifically mentioned otherwise, for all packaging types for bare die products, the term components refers to components as well as singulated die products

2.2 component sizes

all component sizes are identified with their metric size code (size code, followed by a capital M)

Note 1 to entry: To avoid possible confusion with inch-based size codes, an equivalent table is shown in Table 1.

Table 1 – component size codes

Metric size code	Inch size code
0402M	01005
0603M	0201
1005M	0402
1608M	0603
2012M	0805

2.3 packaging

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

2.4 pressed carrier tape

(type 1b) carrier tape with concave cavities formed by compression of the base material

2.5 fluff

(type 1b) fibre from the base material attached inside the cavity

SEE: Figure 1.

2.6 burr

(type 1b) surface projection of tape unintentionally produced when cavity is formed

SEE: Figure 1.

2.7 deformation

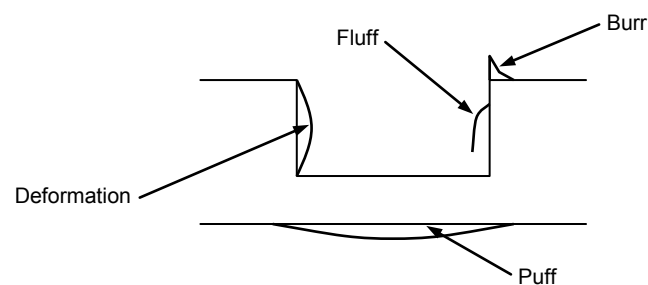
(type 1b) bulge on the inner wall of the cavity

SEE: Figure 1.

2.8 puff

(type 1b) bulge on the reverse side of the cavity

SEE: Figure 1.



IEC 1209/13

Figure 1 – Sectional view of component cavity (type 1b)

2.9

blister carrier tape

tape types 2a, 2b and 3 are identified as blister carrier tapes

Note 1 to entry: These types of carriers are also known as 'embossed' carrier types.

3 Structure of the specification

The various types of tapes are as follows.

NOTE 1 The separation of the prior type 1 into two sub-types 1a and 1b is new in this edition of this standard. Any reference to type 1 not being specific to type 1a or type 1b is considered as referring to type 1a.

Type 1 – Punched and pressed carrier tape

Type 1a: Punched carrier tape, with top and bottom cover tape (tape widths: 8 mm and 12 mm)

Type 1b: Pressed carrier tape, with top cover tape (tape width: 8 mm)

NOTE 2 The separation of the prior type 2 into two sub-types 2a and 2b is new in this edition of this standard. Any reference to type 2 not being specific to type 2a or type 2b is considered as referring to type 2a.

Type 2 – Blister carrier tape, with single round sprocket holes

Type 2a: Blister carrier tape, with single round sprocket holes, with top cover tape and tape pitches down to 2 mm (tape widths: 8 mm, 12 mm, 16 mm and 24 mm)

Type 2b: Blister carrier tape, with single round sprocket holes, with top cover tape and with 1mm tape pitch (tape widths: 4 mm)

Type 3 – Blister carrier tape, with double sprocket holes (tape widths: 32 mm to 200 mm)

Type 4 – Adhesive-backed punched plastic carrier tape for singulated bare die and other surface mount components (tape widths: 8 mm, 12 mm, 16 mm, and 24 mm)

4 Dimensional requirements for taping

4.1 Component cavity positioning requirements

4.1.1 Requirements for types 1a, 1b, 2a, 2b and 3

For defined component positioning, the cavity shall be defined to an origin point. The origin is the centre of the round sprocket hole, defined by the crosshair of the dimensions E_1 and P_0 . The centre of the compartment shall be defined by P_2 and F , relative to the round sprocket hole. When dimension P_1 is smaller or equal to 2 mm, the maximum allowed pocket offset, relative to the centre of the round sprocket hole, shall be applied.

4.1.2 Requirements for types 4

For defined component positioning, the component placement and location shall be defined to an origin. The origin is the centre of the sprocket hole, defined by the crosshair of the dimensions E_1 and P_0 . The centre of the component location shall be defined by P_{2A} and F_A ,

relative to the sprocket hole. Type 4 does not have cavities that are used to position components, therefore all position measurements should be made according to the principle defined here and not to the compartments or 'pockets', which are virtual boundaries for component protection only. The term 'pocket offset' does not apply to type 4. The following applies to tape type 4:

- a) rotation and lateral movement of the component is defined by the accuracy to which it has been placed in the compartment, with reference to the target;
- b) the component shall not protrude above the top surface of the carrier tape (see Figure 23, sketch R);
- c) the components shall not change their orientation within the tape;
- d) the component shall be able to be removed from the cavity or compartment in a vertical direction, without mechanical restriction.

4.2 Component cavity dimension requirements (tape types 1a, 1b, 2a, 2b and 3)

The size of the component cavity, including applicable tolerances, is governed by the dimensions of the component for which the packaging applies, to ensure that the component is adequately protected and that tilt, rotation and lateral movement of the component complies with the requirements detailed for each type of tape. The following applies to tape types 1a, 1b, 2a, 2b and 3:

- a) dimensions $A_0 \leq B_0$, unless otherwise specified in the component detail specification;
- b) maximum and minimum dimensions of the component shall be taken from the component detail specification;
- c) the component shall not protrude above the top surface of the carrier tape, except for type 1a where the component shall not protrude beyond either surface of the carrier tape;
- d) the components shall not change their orientation within the tape;
- e) the component shall be able to be removed from the cavity or compartment in a vertical direction, without mechanical restriction, after the top cover has been removed, where a cover tape is used.

4.3 Type 1a – Punched carrier tape, with top and bottom cover tape (tape widths: 8 mm and 12 mm)

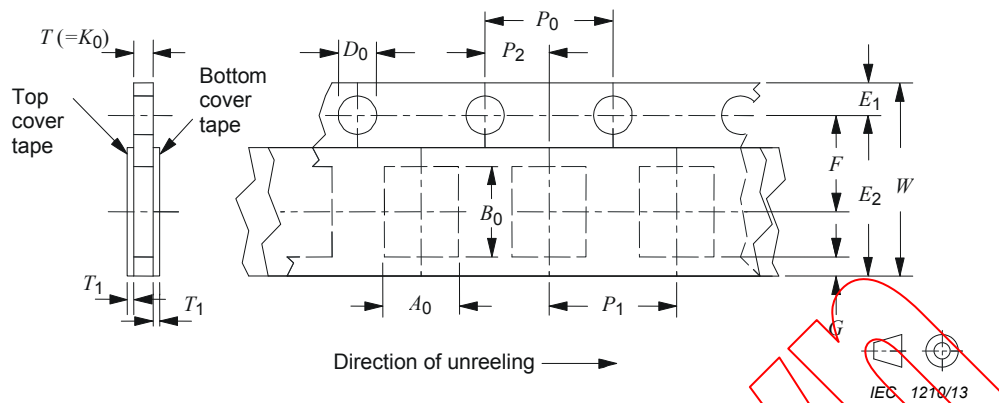


Figure 2 – 8 mm and 12 mm punched carrier-tape dimensions (4 mm cavity pitch)

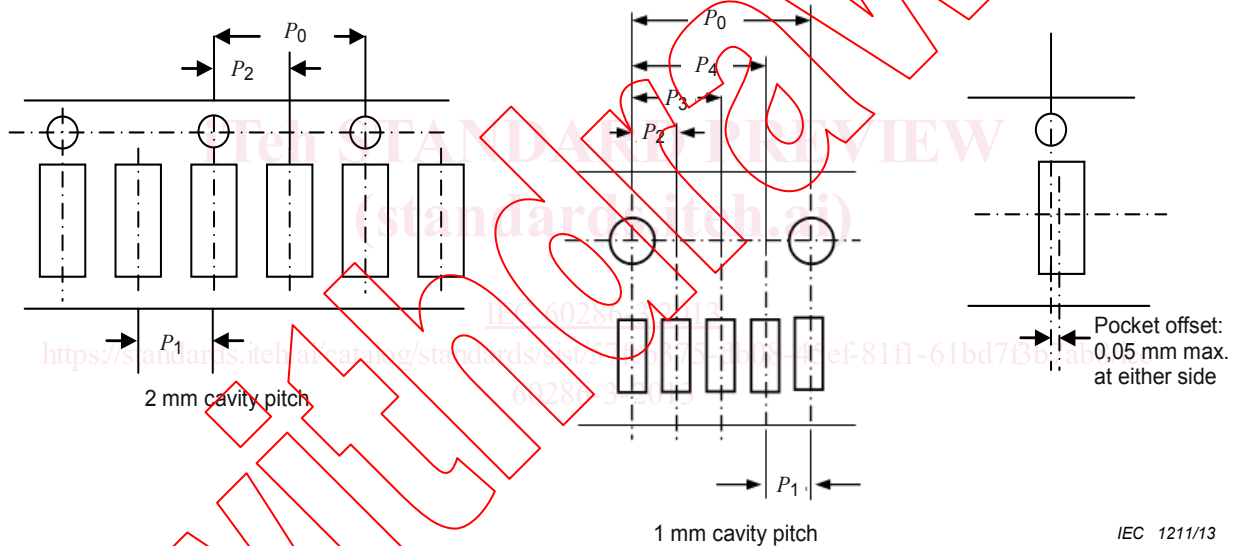


Figure 3 – Illustration of 2 mm and 1 mm cavity pitch and maximum pocket offset

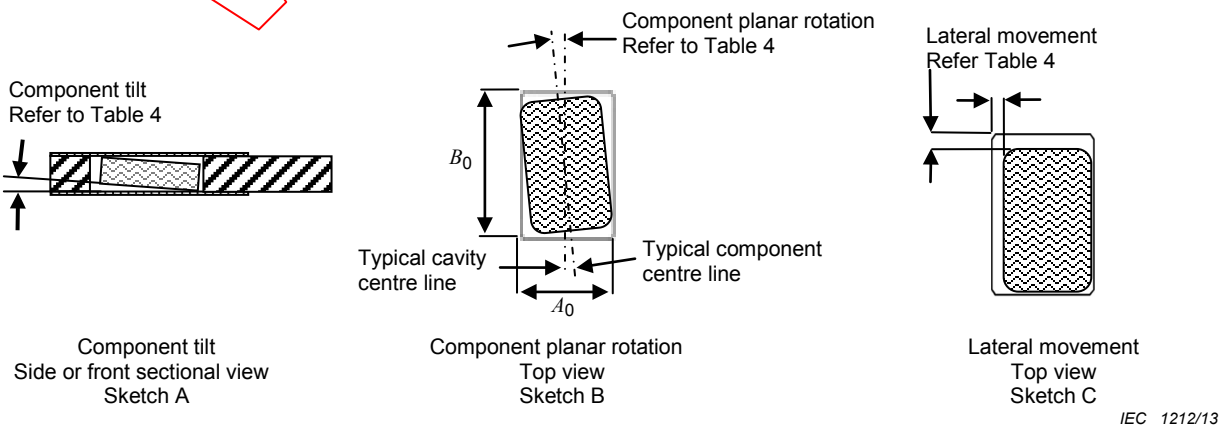


Figure 4 – Maximum component tilt, rotation and lateral movement

Table 2 – Constant dimensions of 8 mm and 12 mm punched carrier tape

Tape size	D_0	E_1	P_0	G_{\min}	T_{\max}	$T_{1\max}$ (each T_1)	P_0 pitch cumulative tolerance
8 and 12	$1,5^{+0,1}_0$	$1,75 \pm 0,1$	$4,0 \pm 0,1$ ($P_1 \geq 4$) $4,0 \pm 0,05$ ($P_1 = 2, P_1 = 1$)	0,75	1,1 paper 1,6 non- paper	0,1	$\pm 0,2 / 10$ pitches

Table 3 – Variable dimensions of 8 mm and 12 mm punched carrier tape

Tape size	$E_2 \min$	F	P_1	P_2	P_3	P_4	W	A_0, B_0, K_0
8	6,25	$3,5 \pm 0,05$	$1,0 \pm 0,05$ ($P_1 = 1$) $2,0 \pm 0,05$ ($P_1 = 2$) $4,0 \pm 0,1$ ($P_1 = 4$)	$1,0 \pm 0,05$ ($P_1 = 1$) $2,0 \pm 0,05$ ($P_1 = 2$) $2,0 \pm 0,05$ ($P_1 = 4$)	$2,0 \pm 0,05$ ($P_1 = 1$)	$3,0 \pm 0,05$ ($P_1 = 1$)	$8,0^{+0,3}_{-0,1}$	See 4.2
12	10,25	$5,5 \pm 0,05$	$2,0 \pm 0,05$ ($P_1 = 2$) $4,0 \pm 0,1$ ($P_1 \geq 4$)	$2,0 \pm 0,05$	–	–	$12,0^{+0,3}_{-0,1}$	

Table 4 – Component tilt, planar rotation and lateral movement

Tape size	Component tilt (design value)	Component planar rotation (design value)	Lateral movement
8 and 12	10° maximum	20° maximum	0,3 maximum ($P_1 = 1, P_1 = 2$) 0,5 maximum ($P_1 \geq 4$)
<p>The trend for allowed component planar rotation of components with either length or width less than 1,2 mm is 10° maximum.</p> <p>For components with either length or width dimensions of less than 1,2 mm, market trends are towards a lateral movement of 0,2 mm maximum.</p> <p>When handling bare die products in tape size 8 mm, the minimum lateral movement of 0,1 mm maximum for either cavity dimension should be allowed.</p> <p>When handling bare die products in tape size 12 mm, the minimum lateral movement of 0,15 mm maximum for either cavity dimension should be allowed.</p>			