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INTERNATIONAL STANDARD

colour
inside

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

IEC 60286-3:2019-01 RLV(en)

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PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

Part 3: Packaging of surface mount components on continuous tapes

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60286-3 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This sixth edition cancels and replaces the fifth 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) addition of a table of the classification to symbols concerning tape, reel and common symbols;
b) additions of a figure of example of polarity and orientation and a figure of example of dot seal;
c) revision of requirements for camber;
d) addition of a definition of design value with regard to tilt.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
40/2643/FDIS	40/2649/RVD

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 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 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- withdrawn,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.

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 therefore print this document using a colour printer.

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.

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

Part 3: Packaging of surface mount components on continuous tapes

~~1 General~~

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

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 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*~~

3 Terms, definitions and symbols

3.1 Terms and definitions

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

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

3.1.1
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~~
electronic part of a product that cannot be physically divided into smaller parts without losing its particular function

Note 1 to entry: This includes singulated die product.

Note 2 to entry: This is applied to all packaging-types for bare die products unless specifically mentioned otherwise.

3.1.2
component sizes

~~all component sizes~~ size of component that are identified with their metric size code

Note 1 to entry: This size code is followed by a capital M.

Note 2 to entry: To avoid possible confusion with inch-based size codes, an ~~equivalent~~ equivalency 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

3.1.3
packaging

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

3.1.4
pressed carrier tape

<type 1b> carrier tape with concave cavities formed by compression of the base material

3.1.5
fluff

<type 1b> fibre from the base material attached inside the cavity

Note 1 to entry: See Figure 1.

3.1.6
burr

<type 1b> surface projection of tape unintentially produced when cavity is formed

Note 1 to entry: See Figure 1.

3.1.7
deformation

<type 1b> bulge on the inner wall of the cavity

Note 1 to entry: See Figure 1.

3.1.8
puff

<type 1b> bulge on the reverse side of the cavity

Note 1 to entry: See Figure 1.

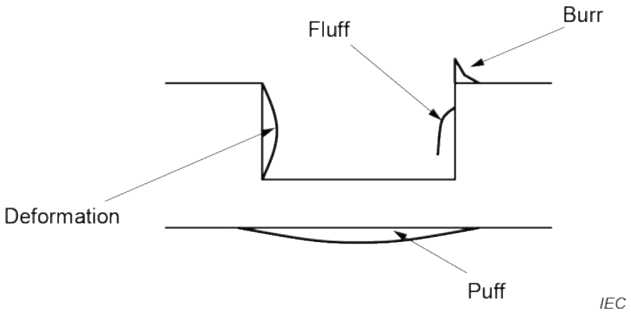


Figure 1 – Sectional view of component cavity (type 1b)

3.1.9
blister carrier tape

~~tape types 2a, 2b and 3 are identified as blister carrier tapes~~ carrier tape which is identified as tape belonging to types 2a, 2b and 3

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

3.2 Symbols

The symbols used in this document are listed in Table 2.

Table 2 – Classification to symbols concerning tape, reel and common symbols

Symbols	Definitions	Figure references
A	Reel diameter	Figure 26
A_0	Cavity’s bottom dimension in direction of unreeling	Figures 2, 4, 5, 7, 8, 10, 11, 13, 14, 16 and 20
B	Reel hole key’s groove width	Figure 27
B_0	Cavity’s bottom dimension in direction of tape width	Figures 2, 4, 5, 7, 8, 10, 11, 13, 14, 16 and 20
B_1	Cavity’s rim in direction of tape width	Figures 8, 11 and 14
C	Reel hole diameter	Figures 26 and 27
C_T	Distance of puff under cavity in direction of tape width	Figure 5
d	Difference of diameter between sprocket hole and round foramen	Figure 14
D	Reel slot diameter	Figure 27
D_0	Sprocket hole diameter	Figures 2, 5, 8, 11, 14 and 17
D_1	Cavity’s bottom hole diameter	Figures 8 and 14
E_1	Shorter distance in direction of width between the origin point of round sprocket hole and the edge of a side of tape	Figures 2, 5, 8, 11, 14 and 17
E_2	Longer distance in direction of width between the origin point of round sprocket hole and the edge of a side of tape	Figures 2, 5, 8 and 11
F	Distance in direction of width between the origin point of round sprocket hole and the centre of cavity	Figures 2, 5, 8, 11 and 14
F_A	Distance in direction of width between the origin point of round sprocket hole and the centre of compartment	Figures 17, 19, 24 and 25
G	Shorter distance in direction of width between the cavity and the edge of a side of tape	Figures 2, 5, 8, 11 and 17
K_0	Cavity depth	Figures 2, 5, 8 ,11 ,14 and A.3
N	Hub diameter	Figure 26

Symbols	Definitions	Figure references
P_0	Pitch of the sprocket holes	Figures 2, 3, 5, 6, 8, 9, 11, 14 and 17
P_1	Cavity pitch	Figures 2, 3, 5, 6, 8, 9, 11, 14, 17 and 18
P_2	Pitch between the centre of a cavity on the same line with the origin point of round sprocket hole and the centre of the next cavity in direction of unreeling	Figures 2, 3, 5, 6, 8, 9, 11 and 14
P_{2A}	Pitch between the centre line of the origin point of round sprocket hole and the centre line of compartment in direction of unreeling	Figures 17, 18, 19, 24 and 25
P_3	Pitch between the centre of a cavity on the same line with the origin point of round sprocket hole and the centre of the second next cavity in direction of unreeling	Figures 3 and 6
P_4	Pitch between the centre of a cavity on the same line with the origin point of round sprocket hole and the centre of the third next cavity in direction of unreeling	Figures 3 and 6
S	Sprocket hole pitch in direction of width	Figure 14
R	Bending radius of carrier tape	Figure 21
r	Curvature radius of reel hole key's groove	Figure 27
T	Carrier tape thickness without cover tape	Figures 2, 5, 8, 11, 14, 17, 25 and A.1
T_1	Top cover tape thickness or bottom cover tape thickness	Figures 2, 5, 8, 11, 14 and 17
T_2	Sum of outer cavity height and top cover tape thickness	Figures 8, 11 and 14
T_3	Thickenss of pressed carrier tape including bulge	Figures 5 and A.1
V_1	Compartment dimension in direcion of unreeling	Figures 17 and 18
V_2	Compartment dimension in direction of width	Figures 17 and 18
W	Carrier tape width	Figures 2, 5, 8, 11, 14 and 17
W_P	Distance between adhesive tapes	Figure 17
W_1	Reel inner width(measured at hub)	Figure 26
W_2	Reel overall width	Figure 26
W_3	Reel inner width in the rim	Figure 26
Z	Component thickness	Figure 25

4 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)

5 Dimensional requirements for taping

5.1 Component cavity positioning requirements

5.1.1 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 (see Figures 2, 5, 8, 11 and 14). 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 (see Figures 3, 6, 9 and 12).

5.1.2 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 (see Figure 17). 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 25, 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.

5.2 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.

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

For respective dimensional codes, see Figures 2 to 4 and Tables 3 to 5.

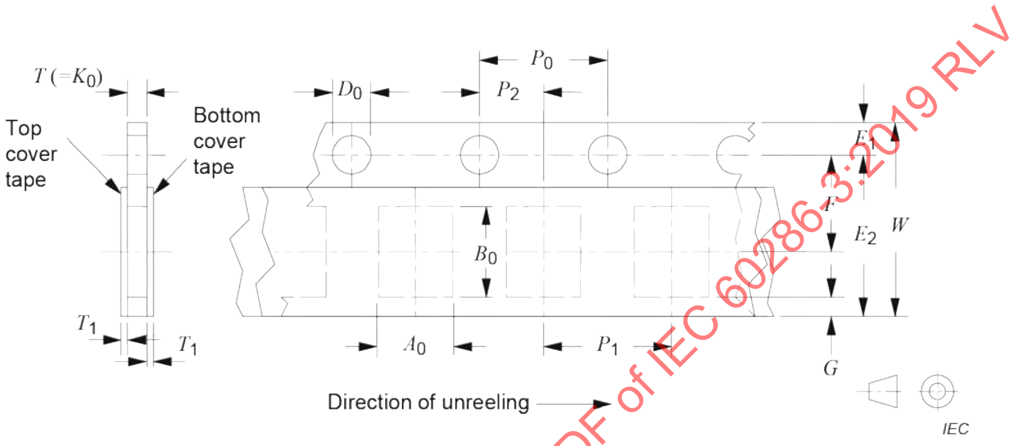


Figure 2 – 8 mm and 12 mm punched carrier tape dimensions (4 mm cavity pitch)

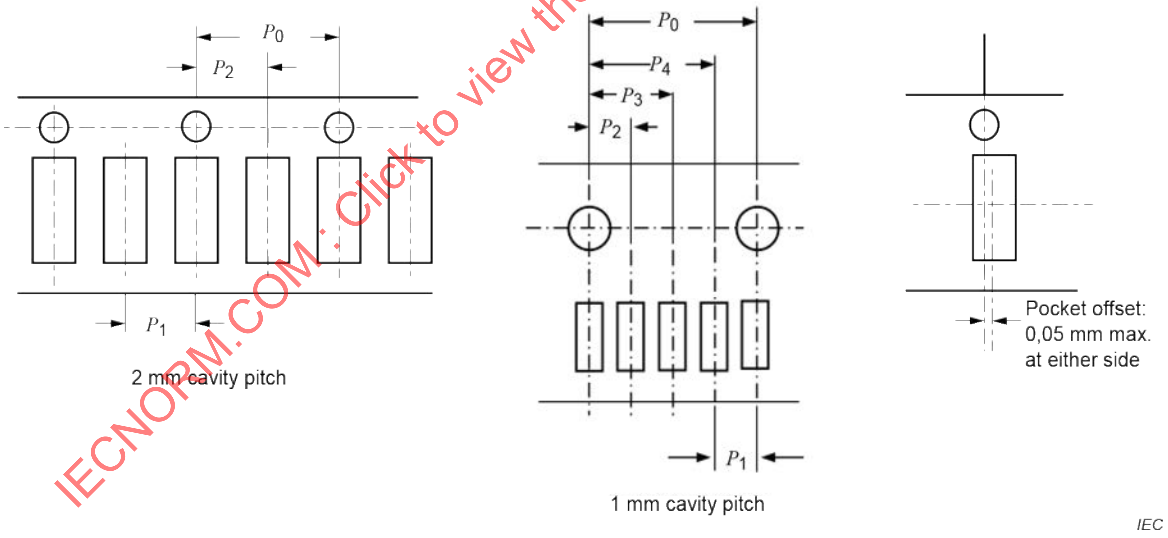
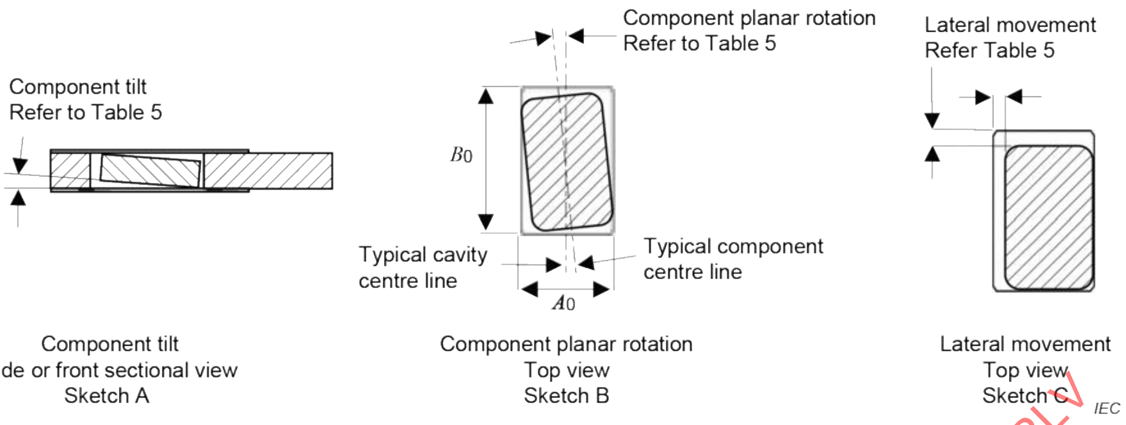


Figure 3 – Illustration of 2 mm and 1 mm cavity pitch and maximum pocket offset



Component tilt
Side or front sectional view
Sketch A

Component planar rotation
Top view
Sketch B

Lateral movement
Top view
Sketch C

Figure 4 – Maximum component tilt, rotation and lateral movement

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

Dimensions in millimetres

Tape size	D_0	E_1	P_0	G min.	T max.	T_1 (each T_1)	**P_0 pitch cumulative tolerance**
8 and 12	$1{,}5^{+0{,}1}_{0}$	1,75 ± 0,1	4,0 ± 0,1 ($P_1 \geq 4$) 4,0 ± 0,05 ($P_1 = 2$, $P_1 = 1$)	0,75	1,1 paper[a] 1,6 non-paper	0,1 maximum	± 0,2 / 10 pitches

For respective dimensional codes, see Figure 2.

[a] The paper is the material of the punched carrier tape.

Table 4 – Variable dimensions of 8 mm and 12 mm punched carrier tape

Dimensions in millimetres

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 ± 0,05	1,0 ± 0,05 $(P_1 = 1)$ 2,0 ± 0,05 $(P_1 = 2)$ 4,0 ± 0,1 $(P_1 = 4)$	1,0 ± 0,05 $(P_1 = 1)$ 2,0 ± 0,05 $(P_1 = 2)$ 2,0 ± 0,05 $(P_1 = 4)$	2,0 ± 0,05 $(P_1 = 1)$	3,0 ± 0,05 $(P_1 = 1)$	$8{,}0\ ^{+0{,}3}_{-0{,}1}$	See 5.2
12	10,25	5,5 ± 0,05	2,0 ± 0,05 $(P_1 = 2)$ 4,0 ± 0,1 $(P_1 \geq 4)$	2,0 ± 0,05	–	–	$12{,}0\ ^{+0{,}3}_{-0{,}1}$	
For respective dimensional codes, see Figures 2 to 4.								

Table 5 – Component tilt, planar rotation and lateral movement

Tape size mm	Component tilt (design value) [a]	Component planar rotation (design value) [a]	Lateral movement mm
8 and 12	10° maximum	20° maximum	0,3 maximum $(P_1 = 1, P_1 = 2)$ 0,5 maximum $(P_1 \geq 4)$
For respective dimensional codes, see Figure 4.			
The trend for allowed component planar rotation of components with either length or width less than 1,2 mm is 10° maximum.			
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.			
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.			
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.			
[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.			

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

For respective dimensional codes, see Figures 5 to 7 and Tables 6 to 8.

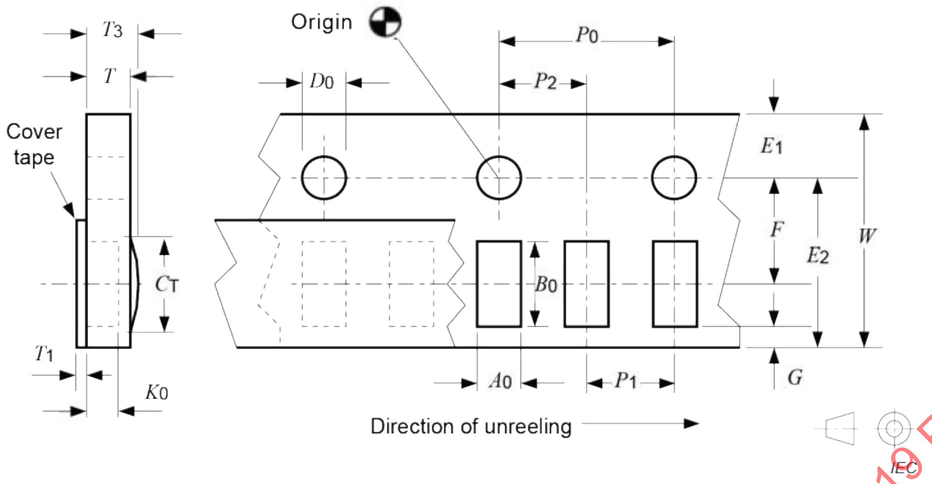


Figure 5 – Dimensions (P_0 = 4 mm/P_1 = 2 mm) and (P_0 = 4 mm/P_1 = 1 mm)

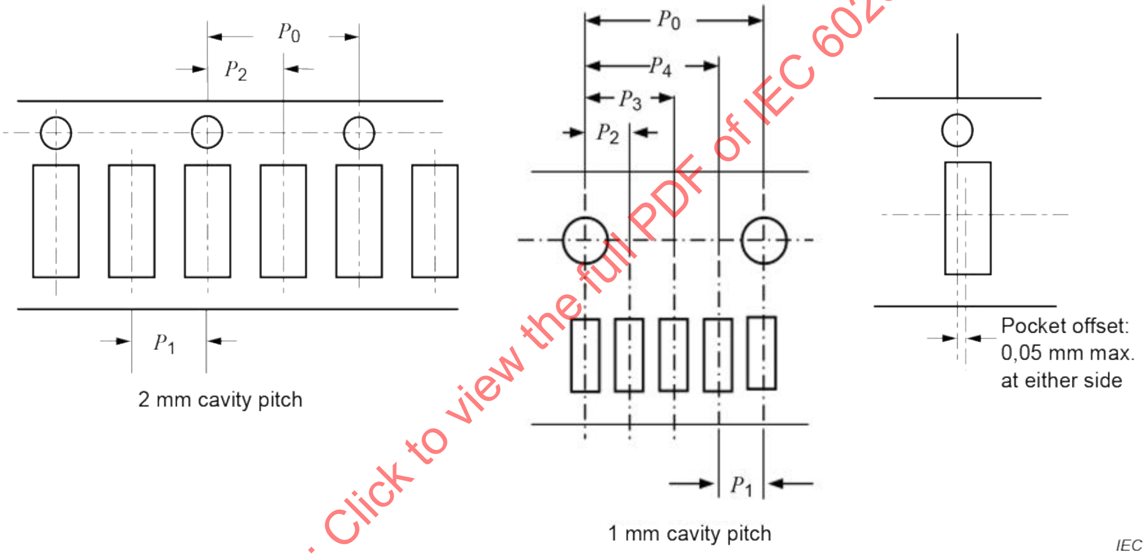


Figure 6 – Illustration of 2 mm and 1 mm cavity pitch and maximum pocket offset

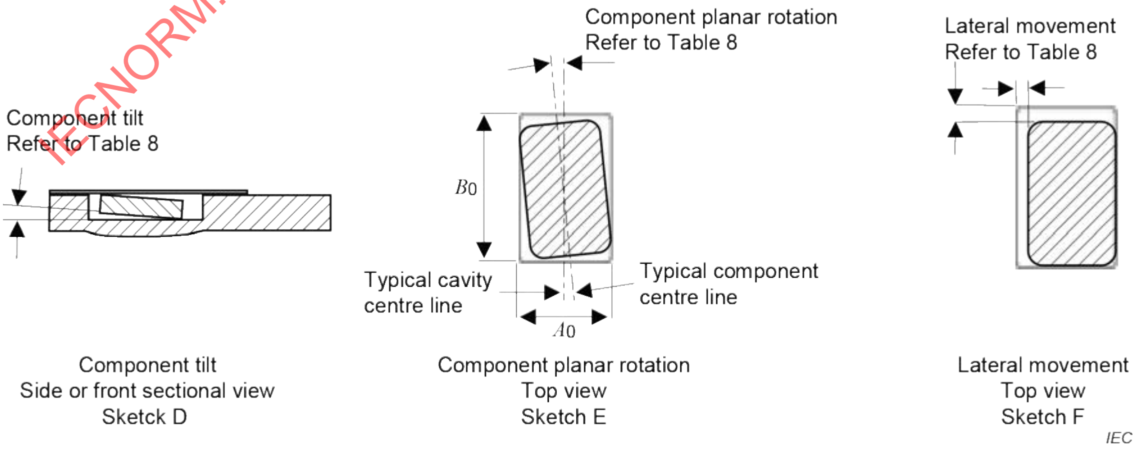


Figure 7 – Maximum component tilt, rotation and lateral movement

Table 6 – Constant dimensions of 8 mm pressed carrier tape

Dimensions in millimetres

Tape size	D_0 [a]	E_1	G min.	P_0	T max.	T_1 max.	T_3-T [b] max.	**P_0 pitch cumulative tolerance**
8	$1{,}5^{+0{,}1}_{0}$	1,75 ± 0,1	0,75	4,0 ± 0,1	1,1	0,1	0,1	± 0,1 / 10 pitches

For respective dimensional codes, see Figures 5 and 6.

[a] If positioning precision is required, for example when components ≤ size 1005M are mounted in a narrow space, then the tolerance on D_0 should be +0,05 / −0,00 mm.

[b] For components with size designation of 1005M or smaller, the puff ($T_3 - T$) should be limited to 0,05 mm maximum.

Table 7 – Variable dimensions of 8 mm pressed carrier tape

Dimensions in millimetres

Tape size	C_T max.	E_2 min.	F	P_1	P_2	P_3	P_4	W	A_0, B_0, K_0
8	4,35	6,25	3,5 ± 0,05	1,0 ± 0,05 (P_1 = 1) 2,0 ± 0,05 (P_1 = 2) 4,0 ± 0,1 (P_1 = 4)	1,0 ± 0,05 (P_1 = 1) 2,0 ± 0,05 (P_1 = 2) 2,0 ± 0,05 (P_1 = 4)	2,0 ± 0,05 (P_1 = 1)	3,0 ± 0,05 (P_1 = 1)	$8{,}0^{+0{,}3}_{-0{,}1}$	See 5.2

For respective dimensional codes, see Figures 5 to 7.

Table 8 – Component tilt, planar rotation and lateral movement

Tape size mm	**Component tilt (design value)** [a]	**Component planar rotation (design value)** [a]	**Lateral movement** mm
8	20° maximum	20° maximum	0,12 maximum (Component size ≤ 0603M) 0,20 maximum (Component size 1005M) 0,30 maximum (Component size ≥ 1608M)

For respective dimensional codes, see Figure 7.

[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.

5.5 Type2a – 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)

For respective dimensional codes, see Figures 8 to 10 and Tables 9 to 11.

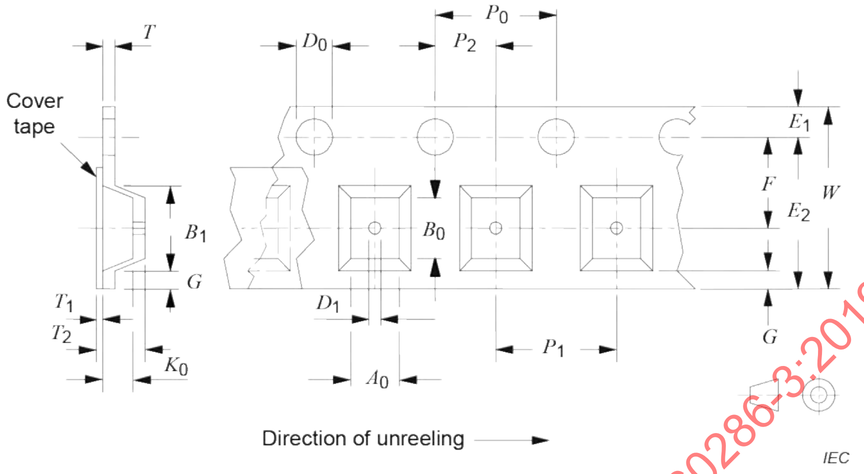


Figure 8 – Blister carrier tape dimensions (8 mm, 12 mm, 16 mm and 24 mm)

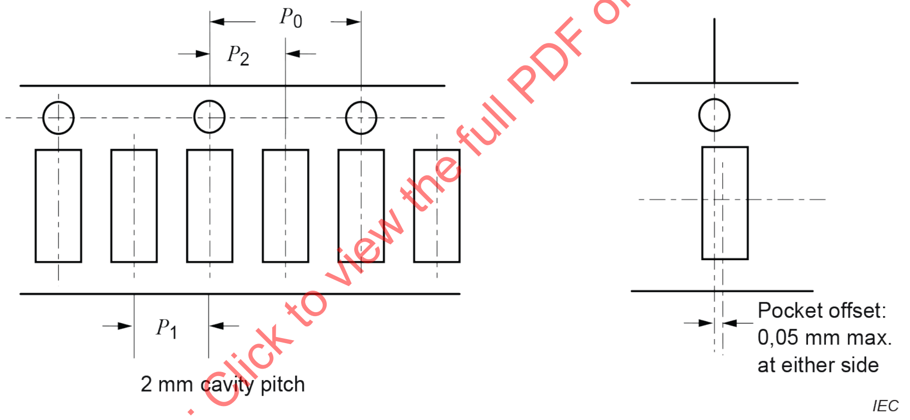
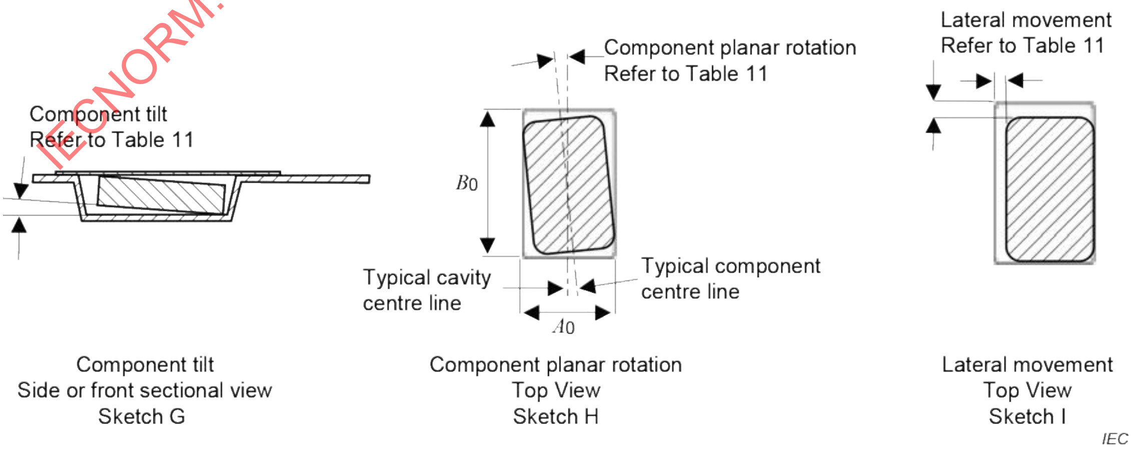


Figure 9 – Illustration of 2 mm cavity pitch and pocket offset



Component tilt
Side or front sectional view
Sketch G

Component planar rotation
Top View
Sketch H

Lateral movement
Top View
Sketch I

Figure 10 – Maximum component tilt, rotation and lateral movement

Table 9 – Constant dimensions of 8 mm to 24 mm blister carrier tape

Dimensions in millimetres

Tape size	D_0	E_1	G min.	P_0	T max.	T_1 max.	P_0 pitch cumulative tolerance
8 to 24	$1{,}5^{+0{,}1}_{0}$	1,75 ± 0,1	0,75	4,0 ± 0,1 ($P_1 \geq 4$) 4,0 ± 0,05 ($P_1 = 2$)	0,6	0,1	±0,2 / 10 pitches
For respective dimensional codes, see Figures 8 and 9.							

Table 10 – Variable dimensions of 8 mm to 24 mm blister carrier tape

Dimensions in millimetres

Tape size	B_1 max.	D_1 [a] min.	E_2 min.	F	P_1	P_2	T_2 max.	W	A_0, B_0, K_0
8	4,35	0,3	6,25	3,5 ± 0,05	2,0 ± 0,05 4,0 ± 0,1	2,0 ± 0,05	3,5	$8{,}0^{+0{,}3}_{-0{,}1}$	See 5.2
12	8,2	1,5	10,25	5,5 ± 0,05	2,0 ± 0,05 4,0 ± 0,1 to 12,0 ± 0,1 in 4,0 increments	2,0 ± 0,05	6,5	$12{,}0^{+0{,}3}_{-0{,}1}$	
16	12,1	1,5	14,25	7,5 ± 0,1	4,0 ± 0,1 to 16,0 ± 0,1 in 4,0 increments	2,0 ± 0,1	9,5	$16{,}0^{+0{,}3}_{-0{,}1}$	
24	20,1	1,5	22,25	11,5 ± 0,1	4,0 ± 0,1 to 24,0 ± 0,1 in 4,0 increments	2,0 ± 0,1	12,5	$24{,}0^{+0{,}3}_{-0{,}1}$	

For respective dimensional codes, see Figures 8 to 10.

[a] Optionally, for easy and reliable removal of the component, or for component inspection or for any applicable application, the cavity may have a hole in the centre of the bottom.

Table 11 – Component tilt, rotation and lateral movement

Tape size mm	Component tilt (design value) [a]	Component planar rotation (design value) [a]	Lateral movement mm
8, 12	10° maximum	20° maximum	0,5 maximum
16, 24	10° maximum	10° maximum	0,5 maximum

For respective dimensional codes, see Figure 10.

The trend for allowed component planar rotation of components with either length or width less than 1,2 mm is 10° maximum.

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.

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.

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.

[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.

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

For respective dimensional codes, see Figures 11 to 13 and Tables 12 to 14.

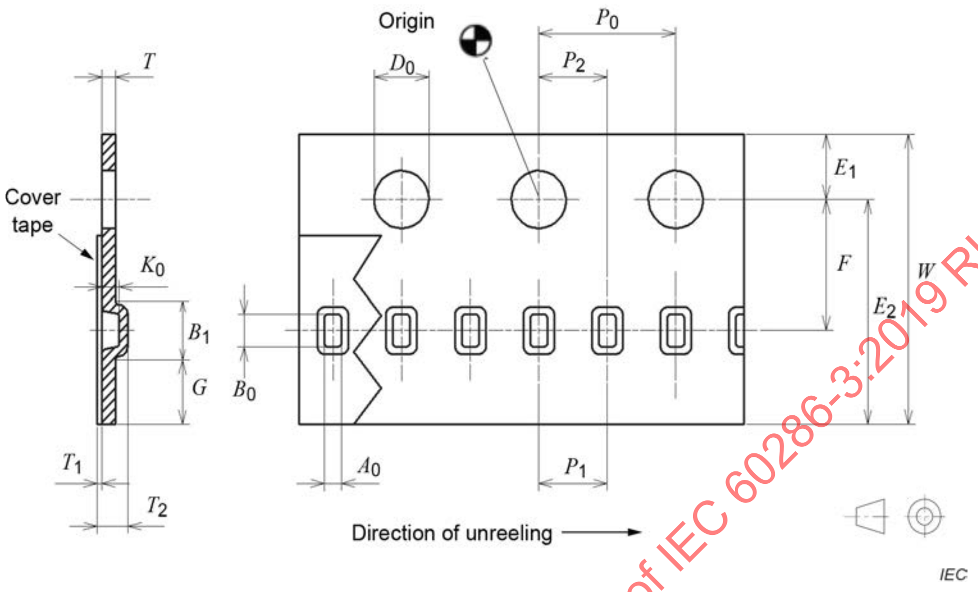


Figure 11 – Type 2b carrier tape

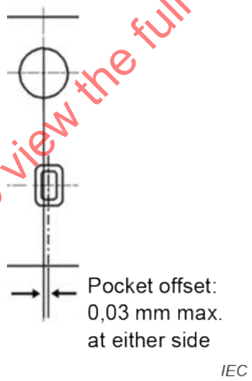
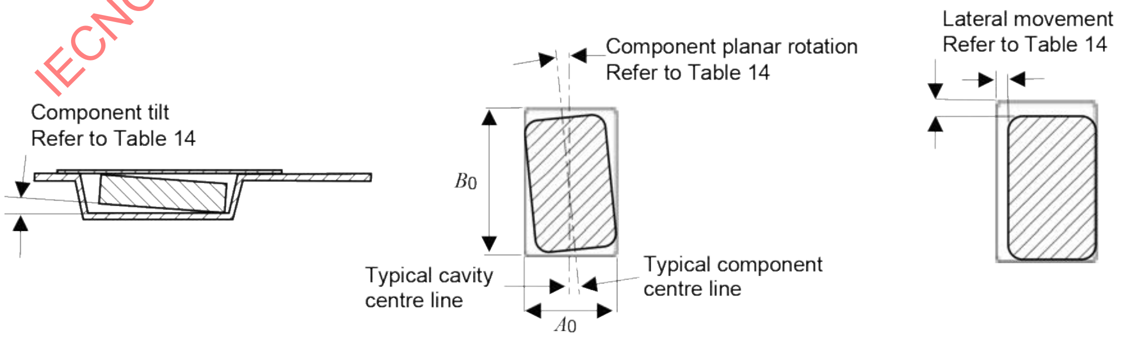


Figure 12 – Maximum pocket offset



Component tilt
Side or front sectional view
Sketch J

Component planar rotation
Top View
Sketch K

Lateral movement
Top View
Sketch L

Figure 13 – Maximum component tilt, rotation and lateral movement

Table 12 – Constant dimensions of 4 mm carrier tape

Dimensions in millimetres

Tape size	D_0	E_1	G min.	P_0	T min.	T max.	T_1 max.	P_0 pitch cumulative tolerance
4	0,80 ± 0,04	0,90 ± 0,05	0,50	2,00 ± 0,04	0,15	0,40	0,08	±0,1 / 20 pitches

For respective dimensional codes, see Figure 11.

Table 13 – Variable dimensions of 4 mm carrier tape

Dimensions in millimetres

Tape size	B_1 max.	E_2 min.	F	P_1	P_2	T_2 max.	W	A_0, B_0, K_0
4	1,48 [a]	3,07	1,8 ± 0,03	1,0 ± 0,03	1,0 ± 0,03	1,1	4,0 ± 0,08	See 5.2

For respective dimensional codes, see Figures 11 and 13.

[a] Reference dimension.

Table 14 – Component tilt, planar rotation and lateral movements

Tape size mm	Component tilt (design value) [a]	Component planar rotation (design value) [a]	Lateral movement mm
4	20° maximum	20° maximum	0,10 maximum (Component size 0402M) 0,12 maximum (Component size 0603M) 0,20 maximum (Component size > 0603M)

For respective dimensional codes, see Figure 13.

[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.

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

For respective dimensional codes, see Figures 14 to 16 and Tables 15 to 17.

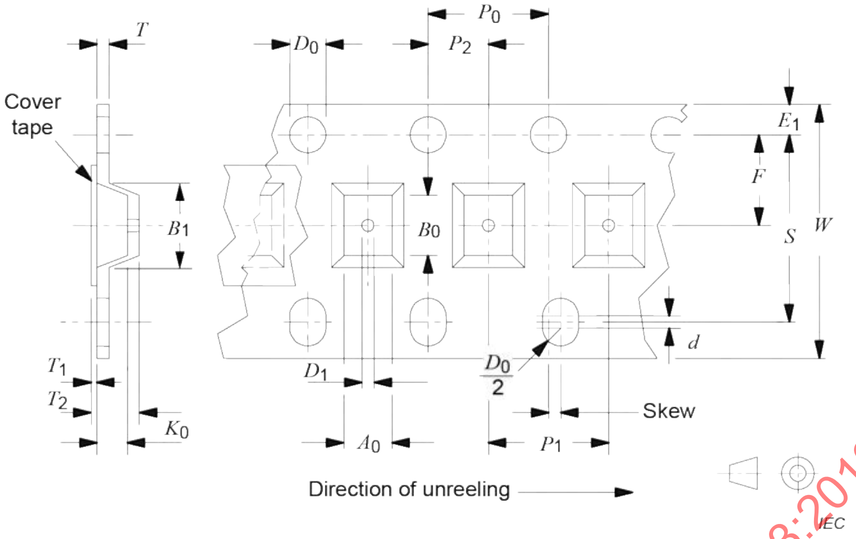


Figure 14 – Blister carrier tape

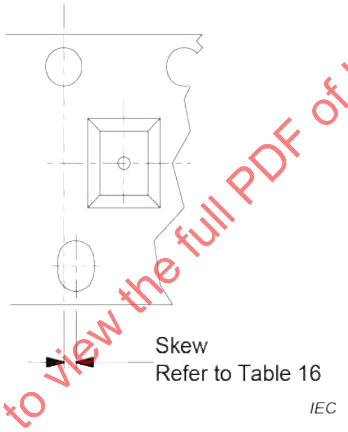
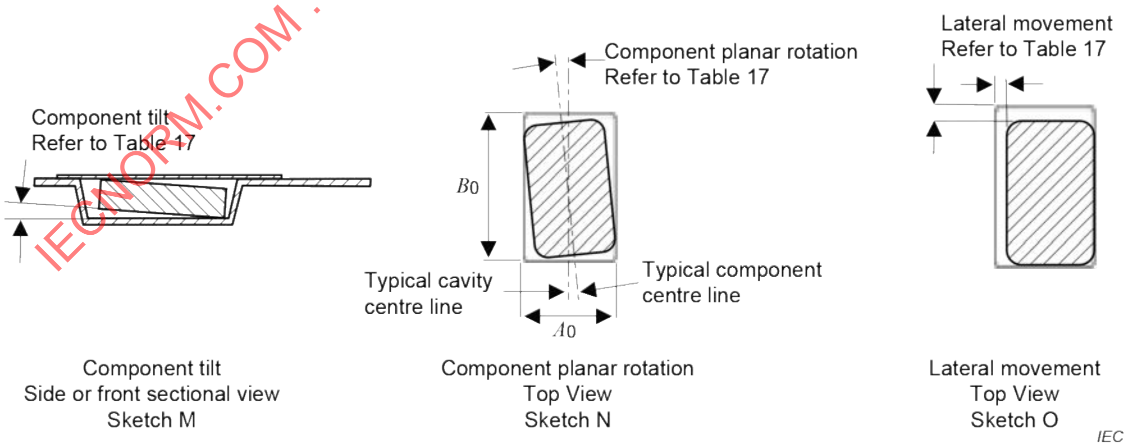


Figure 15 – Elongated sprocket hole skew



Component tilt
Side or front sectional view
Sketch M

Component planar rotation
Top View
Sketch N

Lateral movement
Top View
Sketch O

Figure 16 – Maximum component tilt, rotation and lateral movement

Table 15 – Constant dimensions of 32 mm to 200 mm blister carrier tape

Dimensions in millimetres

Tape size	D_0	D_1 [a] min.	d	E_1	P_0	T max.	T_1 max.	P_0 pitch cumulative tolerance
32 to 200	$1{,}5^{+0{,}1}_{\ \ 0}$	2,0	0,2 ± 0,05	1,75 ± 0,1	4,0 ± 0,1	1,0	0,1	±0,2 / 10 pitches

For respective dimensional codes, see Figure 14.

[a] Optionally, for easy and reliable removal of the component from the compartment of the tape by automatic pick-up equipment, the cavity may have a hole in the centre of the bottom.

Table 16 – Variable dimensions of 32 mm to 200 mm blister carrier tape

Dimensions in millimetres

Tape size	B_1 max.	F	P_1	P_2	S	Skew max.	T_2 max.	W	A_0, B_0, K_0
32	23,0	14,2 ± 0,1	4,0 ± 0,1 to 32,0 ± 0,1 in 4,0 increments	2,0 ± 0,1	28,4 ± 0,1	0,05	12,5	32,0 ± 0,3	See 5.2
44	35,0	20,2 ± 0,1	4,0 ± 0,1 to 44,0 ± 0,1 in 4,0 increments	2,0 ± 0,15	40,4 ± 0,1		16,0	44,0 ± 0,3	
56	46,0	26,2 ± 0,1	4,0 ± 0,1 to 56,0 ± 0,1 in 4,0 increments	2,0 ± 0,15	52,4 ± 0,1		20,0	56,0 ± 0,3	
72	60,0	34,2 ± 0,30	4,0 ± 0,15 to 72,0 ± 0,15 in 4,0 increments	2,0 ± 0,2	68,4 ± 0,1	0,1	30,0	72,0 −0,3/ +0,4	
88	76,0	42,2 ± 0,30			84,4 ± 0,1			88,0 −0,3/ +0,4	
104	91,0	50,2 ± 0,35	4,0 ± 0,20 to 72,0 ± 0,20 in 4,0 increments	2,0 ± 0,25	100,4 ± 0,2	0,15	35,0	104,0 −0,3/ +0,5	
120	107,0	58,2 ± 0,35			116,4 ± 0,2		40,0	120,0 −0,3/ +0,5	
136	123,0	66,2 ± 0,40	4,0 ± 0,25 to 72,0 ± 0,25 in 4,0 increments	2,0 ± 0,3	132,4 ± 0,2			136,0 −0,3/ +0,5	
152	139,0	74,2 ± 0,40			148,4 ± 0,3			152,0 −0,3/ +0,6	
168	153,0	82,2 ± 0,45	4,0 ± 0,30 to 72,0 ± 0,30 in 4,0 increments	2,0 ± 0,35	164,4 ± 0,3	0,2		168,0 −0,3/ +0,6	
184	169,0	90,2 ± 0,45			180,4 ± 0,3			184,0 −0,3/ +0,6	
200	185,0	98,2 ± 0,50	4,0 ± 0,35 to 72,0 ± 0,35 in 4,0 increments	2,0 ± 0,4	196,4 ± 0,3			200,0 −0,3/ +0,6	

For respective dimensional codes, see Figures 14 and 15.

Table 17 – Component tilt, planar rotation and lateral movements

Tape size mm	Component tilt (design value) [a]	Component planar rotation (design value) [a]	Lateral movement mm
32, 44, 56	10° maximum	10° maximum	1,0 maximum
72 to 200	5° maximum	10° maximum	1,0 maximum

For respective dimensional codes, see Figure 16.

[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.

5.8 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)

For respective dimensional codes, see Figures 17 to 19 and Tables 18 to 20. Type 4 carrier is designed specifically for automated handling of components, such as singulated bare die. Components are placed on an adhesive film in compartments. The compartment is defined by dimensions V_1 and V_2, which are virtual boundaries of maximum practical sizes that enable use of a multiple of component footprints. The boundaries shall not be used as fiducials for component placement during taping. Refer to 9.4.2 for component positioning and lateral placement.

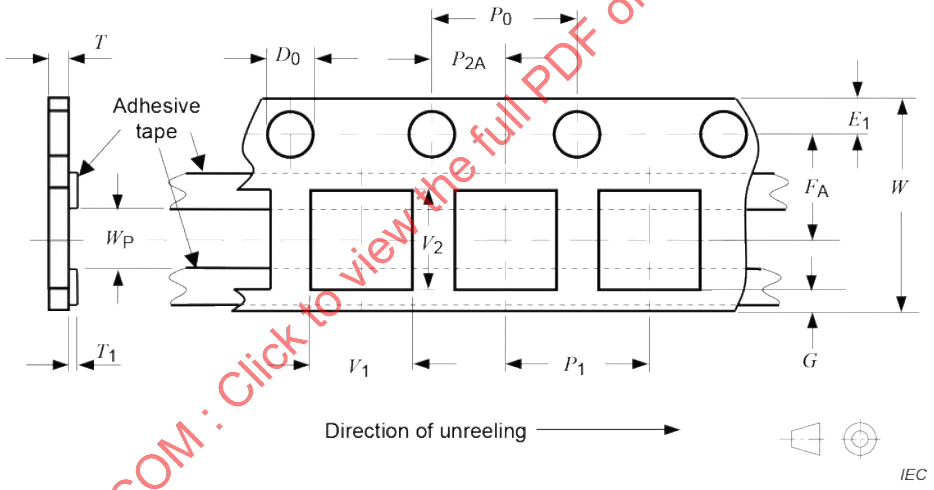


Figure 17 – Adhesive-backed punched carrier-tape dimensions (4 mm compartment pitch)

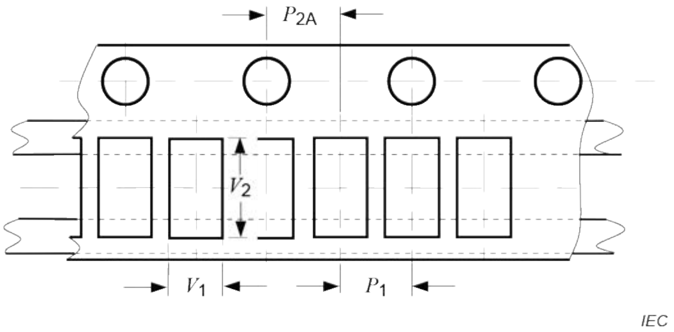


Figure 18 – Illustration of 2 mm compartment pitch

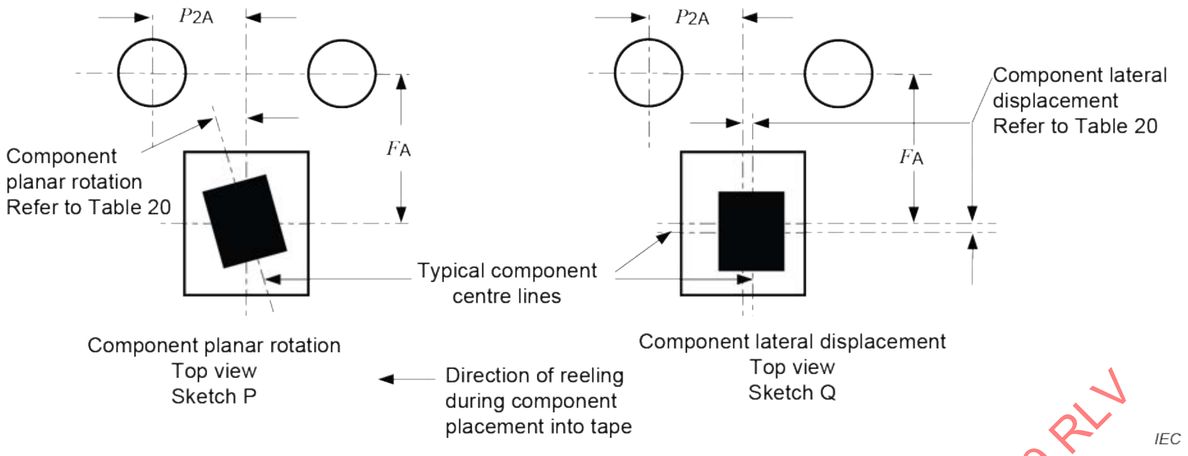


Figure 19 – Maximum component planar rotation and lateral displacement

Table 18 – Dimensions of adhesive backed punched carrier tape

Dimensions in millimetres

Tape size	D_0	E_1	P_0	P_{2A}	T_1 max.	G min.	T max.	~~W_1~~ W_P	P_0 pitch cumulative tolerance
8, 12, 16, 24	$1{,}5^{+0{,}05}_{0}$	1,75 ± 0.1	4,0 ± 0,025	2,0 ± 0,05 (W = 8 and 12) 2,0 ± 0,1 (W = 16 and 24)	0,1	0,75	1,1	See [a, b, c]	± 0,2 / 10 pitches

For respective dimensional codes, see Figures 17 to 19.

[a] Gap ~~W_1~~ W_P is optional and is defined together with the end-user. ~~W_1~~ W_P is determined from the component specifications (dimension B and surface terrain). Its purpose is to

a) minimize adhesion of the component to optimize consistent retrieval at the pick point. This is especially important with components having a surface contact area of 10 mm^2 or greater with the adhesive film;

b) secure retention of component in compartment during reeling/unreeling.

[b] Gap ~~W_1~~ W_P is typically ≤ (0,5 × component dimension ~~B~~ in the direction of V_2).

[c] Gap ~~W_1~~ W_P is centered along the F_A centerline.

Table 19 – Variable dimensions of adhesive-backed punched carrier tape

Dimensions in millimetres

Tape size	F_A	P_1	V_1	V_2	W
8	3,50 ± 0,05	2,0 ± 0,05 4,0 ± 0,1	1,5	3,1	$8{,}0^{+0{,}2}_{-0{,}1}$
			3,1	3,1	
12	5,50 ± 0,05	2,0 ± 0,05 4,0 ± 0,1 to 12,0 ± 0,1 in 4,0 increments	1,5	6,35	$12{,}0^{+0{,}2}_{-0{,}1}$
			3,1	6,35	
			6,35	6,35	
16	7,50 ± 0,05	4,0 ± 0,1 to 16,0 ± 0,1 in 4,0 increments	6,35	10,2	$16{,}0^{+0{,}2}_{-0{,}1}$
			10,2	10,2	
24	11,50 ± 0,05	4,0 ± 0,1 to 24,0 ± 0,1 in 4,0 increments	10,2	17,3	$24{,}0^{+0{,}2}_{-0{,}1}$
			14,0	17,3	

For respective dimensional codes, see Figures 17 to 19.

NOTE Dimension E_2, as defined in tape types 1a, 1b, 2a and 2b, is for type 4 tape minimum value only, but can be derived as a reference dimension by subtracting E_1 from W (maximum).

Table 20 – Component planar rotation and lateral displacement

Tape size mm	Component planar rotation ~~(design value)~~	Component lateral displacement mm
8, 12, 16 and 24	5° maximum	0,05 maximum (P_1 = 2) 0,1 maximum (P_1 = 4)

For respective dimensional codes, see Figure 19.

6 Polarity and orientation requirements of components in the tape

6.1 Requirements for all tape types

For all tape types, the following requirements apply.

a) All polarized components shall be oriented in one direction. For components with two terminations, the cathode side shall be either adjacent to the round sprocket hole or the last one to leave the package, unless otherwise specified in the detail specification.

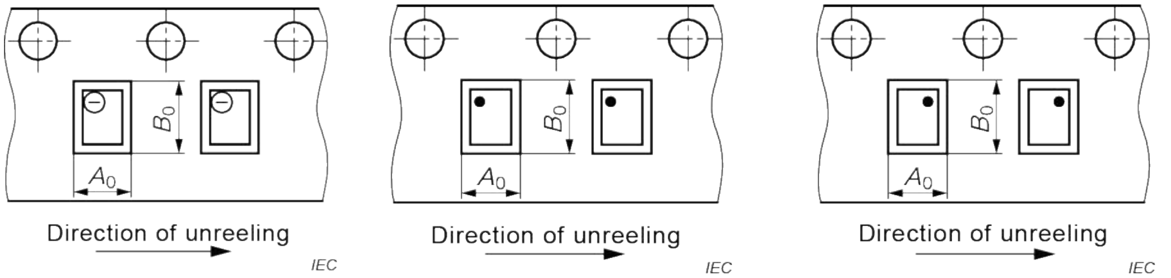
b) For components in flat packages (for example, chip carriers and SO-packages) with more than two terminations, termination No. 1 shall be adjacent to the round sprocket hole, unless otherwise specified in the detail specification.

c) For die products (bare die or bumped die) with more than two pads or terminations, pad No. 1 shall be located on the side adjacent to the round sprocket hole, unless otherwise specified in the detail specification.

d) For components with a lead configuration corresponding to IEC 60191-2, the component side from which one single termination emerges shall be at the compartment side closest to the round sprocket holes in the tape and the mounting side shall face the bottom of the component compartment.

e) For quartz-crystal units with two terminations located on one side of the package, the terminations shall be located at the round sprocket hole side.

f) The polarity or orientation of components with other shapes or termination configurations shall be stated in the detail specification.



a) Cathode is in the upper left

b) Termination No.1 is in the upper left

c) Termination No.1 is in the upper right

The graphical symbol "-", which stands for the position of the cathode side, is shown in a). The mark "●", which stands for the position of termination No.1, is shown in b). Another position of termination No.1 is shown in c), where the position cannot be settled as in b).

Figure 20 – Example of polarity and orientation

6.2 Specific requirements for type 1a

Type 1a has effectively a cover tape on either side. Therefore, components may be placed with the mounting side orientated to the bottom or the top side of the tape (for the bottom side of the tape, see 11.1). If the mounting side needs to be reversed (as is the case for some surface-mounted components), then the tape is re-spooled and the alternate cover tape removed, effectively inverting the component.

6.3 Specific requirements for type 4

The non-active side of the component is generally placed at the bottom side of the tape, i.e. affixed to the adhesive layer. This orientation enables additional visual inspection and probe testing 'in-situ', within an open compartment, since a cover tape is not required for component retention. In the case of flip-chips or WLCSP, the component may be placed 'bumps down' on a special adhesive layer designed for that purpose. Bumps down orientation, on adhesive tape, protects the bumps from damage attributable to abrasion or mechanical handling.

7 Carrier tape requirements

7.1 Taping materials

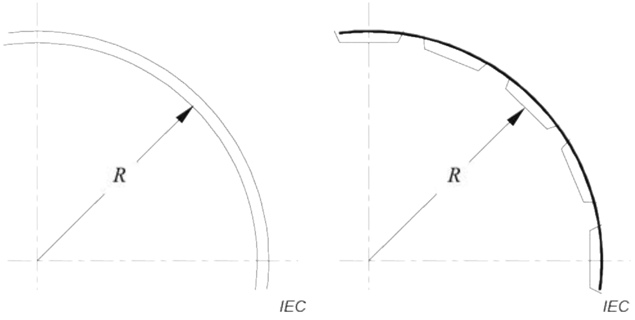
Taping materials and techniques shall be selected to avoid damage to electrostatic-sensitive components.

7.2 Minimum bending radius (for all types)

When the tape is bent with the minimum radius (measured at the bottom side of the tape, see Figure 21) given for a particular tape width as indicated in Table 21, the tape shall not be damaged and the components shall maintain their position and orientation in the tape.

Tape material should have such properties that without additional assistance the material can easily bend to the radius specified in Table 21. Otherwise, the tape cannot be handled anymore.

Tape with components shall pass around the radius R ~~min~~ specified in Table 21 without damage.



Punched tape Blister tape

Figure 21 – Bending radius

Table 21 – Minimum bending radius

Dimensions in millimetres

W	P_1	R min.	
		Types 1a, 1b, 2a, 2b and 3	**Type 4 only** [b]
4	1	25	25
8	1/2/4	25	25
12	2/4/8	30[a]	50
16	4/8/12/16	30	50
24	4/8/12	30	50
24	16/24	30	89
32	4 to 32	40	n/a
44	4 to 44	40	n/a
56	4 to 56	50	n/a
72 to 200	4 to 72[b]	75	n/a

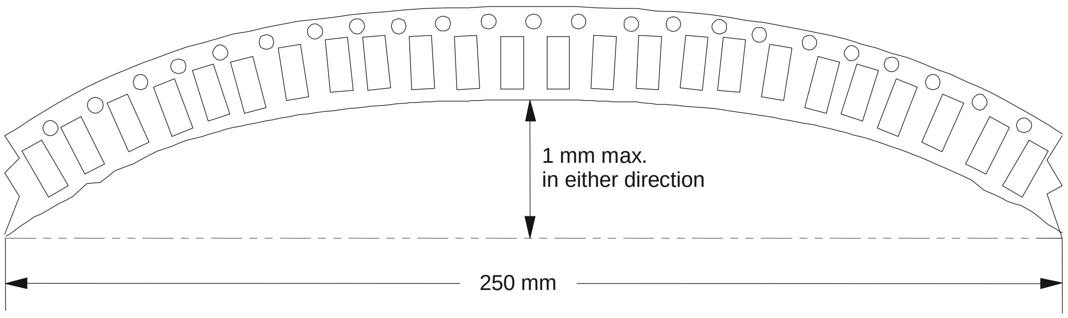
n/a Not applicable.

[a] For punched tapes, the minimum bending radius shall be 25 mm.

[b] The minimum bending radius for the tape with components is proportional to the component dimension in the V_1 direction of the carrier tape compartment. A minimum bending radius of 100 mm is recommended for 24 mm tapes containing singulated bare die when the component/compartment pitch P_1 (Figure 17) is 16 mm. When required, a length of carrier tape trailer can be spooled on the reel to increase effective reel hub diameter N (Figure 26).

7.3 Camber

The camber shall be measured with the carrier tape passed between two plates and without tension applied to the tape ~~according to Figure 21~~. To measure camber accurately, both left and right edges of the 250-mm carrier tape shall be in contact with the straight edge. Measure the largest camber between two edges of the tape in accordance with Figure 22. The camber shall not exceed 1 mm over 250 mm in either direction, unless otherwise specified in the relevant specification.



IEC 1228/13

~~**Figure 21 – Camber (top view)**~~

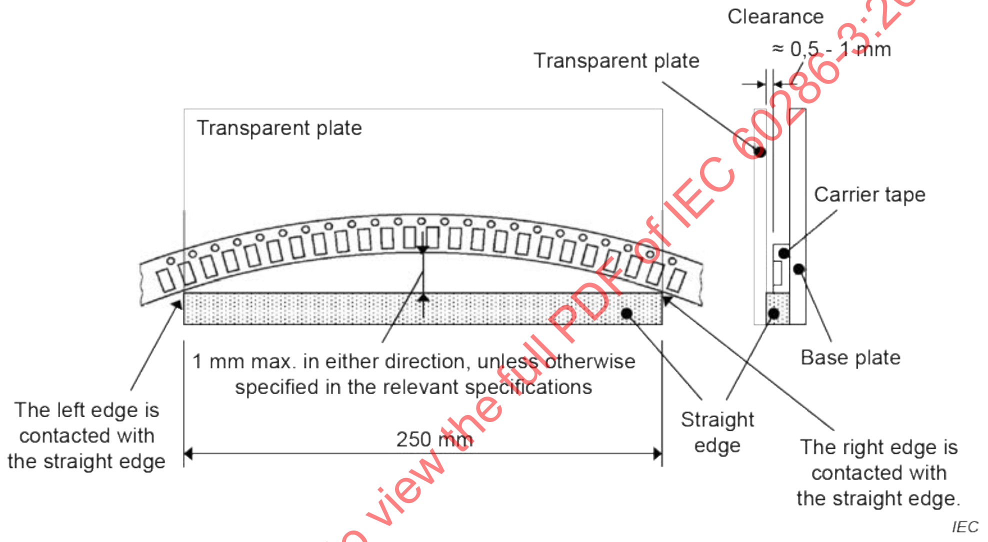


Figure 22 – Measuring method and camber

8 Cover tape requirements (for types 1a, 1b, 2a, 2b and 3)

For tape types 1a, 1b, 2a, 2b and 3 the following cover tape requirements apply.

a) The cover tapes shall not cover the round sprocket holes (types 1a, 1b, 2a, 2b and 3) and elongated sprocket holes (type 3).

b) The adhesive and material of the cover tape shall not adversely affect the mechanical and electrical characteristics and the marking of the components.

c) Components shall not stick to the carrier tape or to the cover tape.

d) The cover tape(s) shall not become detached.

e) The cover tape(s) shall not protrude beyond the edge of the tape.

f) The cover tape shall not be attached to the carrier tape on the surface between two adjacent component pockets.

~~NOTE~~ An exception may apply in those cases where thin components, during reeling or de-reeling,~~ may~~ can slide from pocket to pocket. In these cases, the surface between two adjacent pockets may be dot sealed according the peel force requirements (see Figure 23).

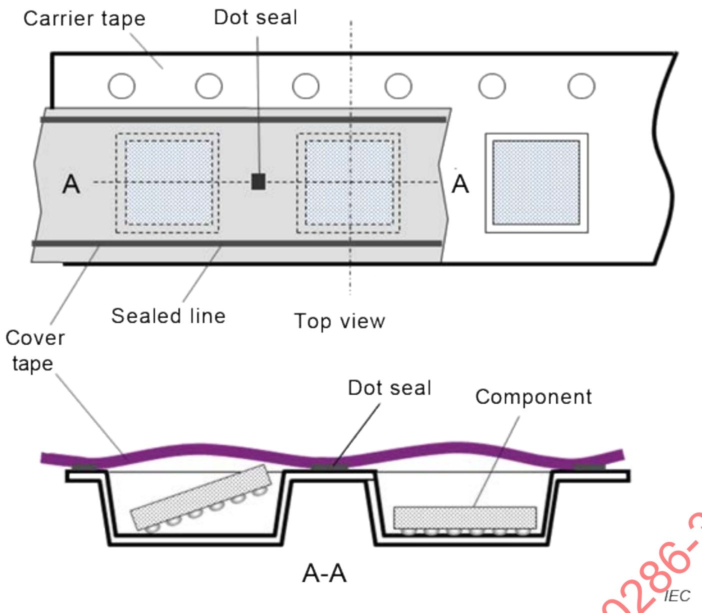


Figure 23 – Dot seals for thin components (as exceptions)

g) The break force of the cover tape shall be 10 N min.

h) The angle at the peel strength test between the cover tape during peel-off and the direction of unreeling shall be 165° to 180°. The cover tape shall adhere uniformly to the carrier tape along both sides in the direction of unreeling.

i) The peel force with a peel speed of 300 mm/min ± 10 mm/min shall be as indicated in Table 22.

Table 22 – Peel force

Tape width *W*	**Peel force**
4 mm	0,1 N to 0,7 N
8 mm	0,1 N to 1,0 N
12 mm to 56 mm	0,1 N to 1,3 N
72 mm to 200 mm	0,1 N to 1,5 N
Tape types 1a, 1b and 2b: For ultra small components 0603M size or smaller, the mass is so light that components may run-off from the component compartment when the cover tape is peeled. For these component sizes it is recommended to use a peel force of 0,2 N ± 0,1 N and, as aging may have an effect on the peel force, this peel force should be valid for at least 7 days after sealing. Unless specifically requested by the end-user, the sale of tapes shall not be reversed.	

9 Component taping and additional tape requirements

9.1 All types

Components shall be prevented from falling out of the component window of the tape. This is normally done by cover tapes on one (blister-tape) or both (punched-tape) sides of the carrier tape. Requirements for types 1a, 1b, 2a, 2b and 3, which use cover tapes, are listed in Clause 8. Type 4 does not require a cover tape, because components are affixed to the adhesive backing when taped and are held in position.

Tapes in adjacent layers shall not stick together, when wound on the reel.

The tapes shall be suitable to withstand storage of the taped components without danger of migration of the terminations or the giving off of vapours which would make soldering difficult or deteriorate the component properties or terminations by chemical action.

The carrier tape material shall not age and lose strength so that it breaks on unreeling when the taped components are fed from the package by hand into the assembly machines. Carrier materials shall not delaminate in a manner that would prevent proper delivery of the component in the assembly process.

The break force of the tape in the direction of unreeling shall be at least 10 N. Properties of the splice tape should be such that it can be attached to the surface of the carrier tape and cover tape and will not hamper the transport of the carrier tape and cover tape. When splicing is applied, the misalignment of the holes on each side of the splice shall not be greater than ±0,15 mm in any direction.

To minimize the effect of losing components by electrostatic discharge, it is recommended that the packaging materials, component placement equipment, and controlled environmental conditions be optimized to effectively dissipate any charge build-up. This charge, commonly referred to as tribo-electric charge, should be controlled~~ according to the guidelines in IEC 61340-5-1 and IEC/TR 61340-5-2~~.

NOTE See IEC 61340-5-1 and IEC/TR 61340-5-2 for the guidelines.

9.2 Specific requirements for type 1b

The presence of burr, fluff or deformation should be kept to a minimum and shall not affect the removal of components. The presence of fluff shall not affect the mounting of the component.

Recommended measuring methods for carrier tape thickness (T and T_3), cavity (A_0 and B_0) and cavity depth (dimension K_0) shall be in accordance with Annex A.

9.3 Specific tape requirements for type 2b

The carrier tape and cover tape shall be made of a plastic material which does not shed particulates and has antistatic characteristics.

The carrier tape material should be suitable for use in the applicable cleanroom classification for which it is intended.

9.4 Specific requirement for type 4

9.4.1 General

Components shall be prevented from falling off the adhesive backing of the carrier tape and shall remain in fixed position for automatic handling. Components shall be firmly affixed to the adhesive backing. No lateral or rotational movement of the component is allowed after placement on the adhesive backing.

During unreeling, components shall be capable of clean release from the carrier tape, without damage or adhesive residue.

The adhesive backing shall remain in position and not become detached.

9.4.2 Coordinate system

For the coordinate system of tape type 4, the following requirements apply.

a) The coordinate system shown in Figure 24 is established to define carrier tape dimensioning together with component placements on adhesive-backed punched plastic carrier tapes.

b) The abscissa is a 0-0 datum straight line of infinite length to align the centres of a plurality of round sprocket holes throughout the entire length of the continuous tapes.

c) Ordinates are lines at right angles to the abscissa and uniformly spaced along its length to position the centre of each round sprocket hole aligned along the abscissa.

d) Compartments within the punched plastic carrier tape comprise virtual boundaries for the placement of components at predetermined pitch intervals throughout the length of the carrier tape.

e) Horizontal and vertical coordinates dimensioned from the abscissa and ordinates establish target location centre points for the planar centroids of the components placed within each virtual boundary.

f) The centre of the components shall be located within a 0,2 mm diameter of the target centerpoints within the virtual boundaries. See Figures 24 and 25.

g) Component rotation shall be limited to 5° from the abscissa axis centre line of the round sprocket holes (see Figure 19).

h) Adherence to the tolerances defined in Table 18 and Table 19 ensures that the following critical criteria are maintained:

   1) precise alignment of all round sprocket hole centres along abscissa;
   2) consistent pitch of the round sprocket holes throughout the entire length of the tape;
   3) uniform diameters of all round sprocket holes;
   4) polarity and orientation of components in the tape.

Table 23 – Absolute referencing data for component target position

Dimensions in millimetres

Tape size	F_A	P_{2A}
8	3,5	2,0
12	5,5	2,0
16	7,5	2,0
24	11,5	2,0

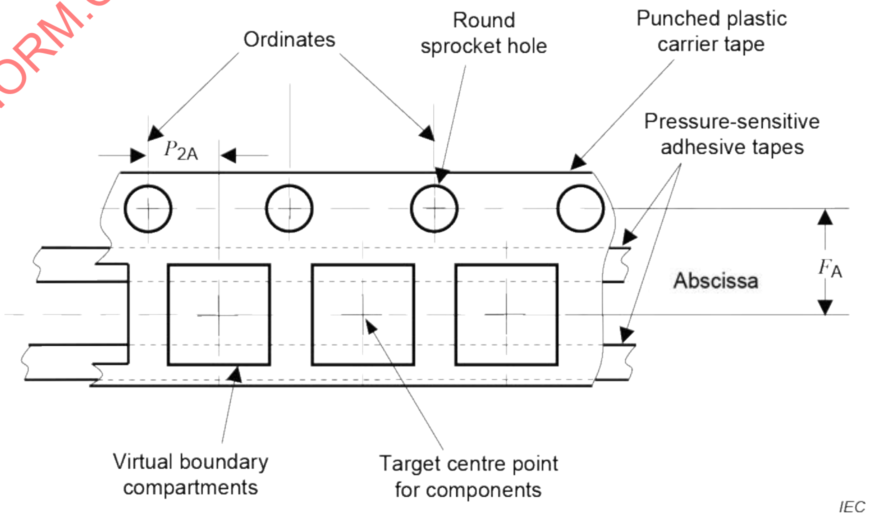


Figure 24 – Type 4 coordinate system

9.4.3 Component positioning and lateral displacement

For the component positioning and lateral displacement, see Figures 19 and 25. The component position in type 4 tape is not measured with respect to the compartment, as in types 1a, 1b, 2a, 2b and 3, but relative to a virtual target point at an absolute position given by P_{2A} and F_A. Table 23 gives the absolute position of this target point relative to the sprocket-hole centroid for different tape sizes.

The maximum displacement of the actual component position from this target location is shown in sketch S of Figure 25 and may be negative or positive. This displacement is a function of the accuracy of the component placement system and not the tape.

It is normal for the user drawing to specify the maximum component rotational and lateral displacement of the component when delivered in type 4, which may have a tighter tolerance than that shown in sketches R and S of Figure 25, where the repeatability of the component position at the pick point is critical. The component should not protrude above the top surface of the carrier tape. This is shown in Sketch R of Figure 25 where the component thickness (Z) shall not be more than the punched tape thickness (T).

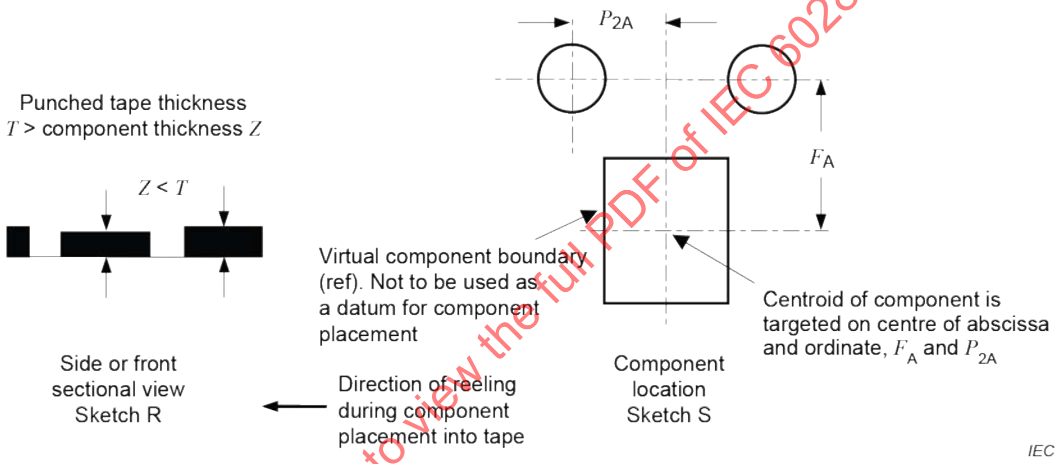


Figure 25 – Component clearance and positioning method

9.5 Specific requirements for tapes containing die products

9.5.1 General

Die products such as bare die and bumped die (flip-chip) require special handling to ensure the dies are not damaged during tape loading, transportation, storage and unloading. Tapes designed for these types of product normally contain certain design features to protect the die and prevent edge or corner chipping from occurring and, in the case of bumped die, to protect the bumps from damage. Particular care should be taken to prevent very thin die from sliding under the cover tape between adjacent pockets.

~~For further guidance on recommended handling of die products, refer to IEC/TR 62258-3.~~

NOTE Refer to IEC/TR 62258-3 for handling recommendations.

The following items should be considered where the tape is used for die products.

9.5.2 Tape design for tapes containing die products

Types 1a, 2a, and 2b should have special design features to ensure the corners of the die do not contact the corners of the pocket. A square or circular relief may be used.

Types 2a and 2b should include special features in the base of the cavity to protect bumped die, where the die are placed in the pocket ‘bumps down’.

Type 4 does not require special features since it is inherently designed for die products.

NOTE Types 1b and type 3 are not suitable for use with die products.

9.5.3 Cleanliness

Tapes that are to be used for storing die products shall be in compliance with clean room class requirements. The sealed bags containing the tape shall only be opened in a suitable environment such as a clean room.

Tapes shall be free from any burrs or particles that may dislodge during handling or storage; they may stick to the surface of the die and cause damage.

Precautions should also be taken to ensure that no fibres or residue are released that could adhere to, or damage, the die product when the cover tape is removed.

9.5.4 Die lateral movement (types 1a, 2a and 2b)

The edges of die products are fragile and the design of the pocket in the tape should provide for minimal lateral movement of the die within the pocket during loading, unloading and transportation. Special punching or forming may be required to achieve the necessary tolerances to minimize lateral movement.

Die products generally require tighter tape tolerances to minimize lateral movement.

Tapes with a width W of 8 mm and 4 mm should allow for a lateral movement of 0,1 mm maximum. Tapes with a width W of more than 8 mm should allow for a lateral movement of 0,15 mm maximum.

10 Reel requirements

10.1 Dimensions

10.1.1 General

For the reeling of tapes, reels with the essential dimensions listed hereinafter shall be used. The total number of components on the reel shall be such that the components and the final cover do not extend beyond the smallest dimension of the flange (in the radial direction).

10.1.2 Reel dimensions

For the reel dimensions, see Figure 26 and Table 24.

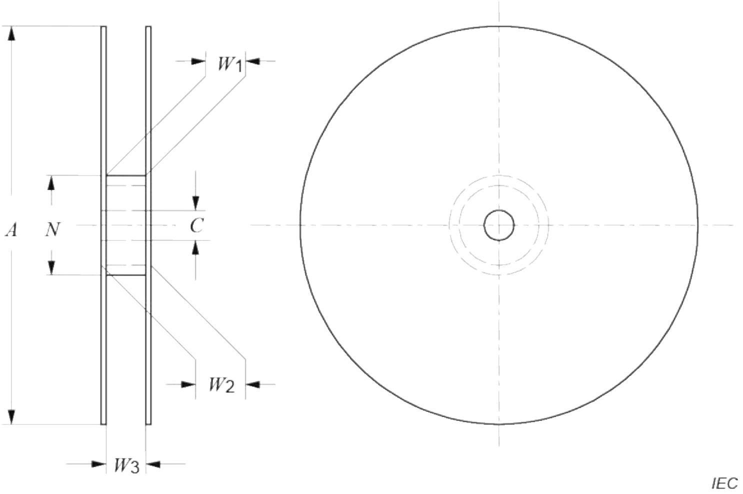


Figure 26 – Reel

Table 24 – Reel dimensions

Dimensions in millimetres

Tape width W	Reel diameter[a] A	Hub diameter N	Reel inner width W_1 [b]	Reel overall width W_2	Reel inner width W_3	Reel inner width W_3
	max.	min.		max.	min.	max.
4	180	50	4,2 + 0,75	7,95	3,9	5,95
8	382	50	8,4 + 1,5	14,4	7,9	10,9
12		60 [d]	12,4 + 2	18,4	11,9	15,4
16		60	16,4 + 2	22,4	15,9	19,4
24		60 [c]	24,4 + 2	30,4	23,9	27,4
32		80	32,4 + 2	38,4	31,9	35,4
44		80	44,4 + 2	50,4	43,9	47,4
56		100	56,4 + 2	62,4	55,9	59,4
72	609	150	72,4 min.	89,0	Shall accommodate tape width without interference	
88			88,4 min.	105,0		
104			104,4 min.	121,0		
120			120,4 min.	137,0		
136			136,4 min.	153,0		
152			152,4 min.	169,0		
168			168,4 min.	185,0		
184			184,4 min.	201,0		
200			200,4 min.	217,0		

For the respective dimensional codes, see Figures 26.

[a] Preferred nominal reel diameters, in millimetres, are 180, 254, 284, 330, 360, 382 and 560. Market trend is towards a larger diameter.

[b] Measured at the hub.

[c] For type 4: 100 min.

[d] For punched tapes, the minimum diameter shall be 50 mm.

10.1.3 Reel hole dimensions

For the reel hole dimensions, see Figure 27 and Table 25.

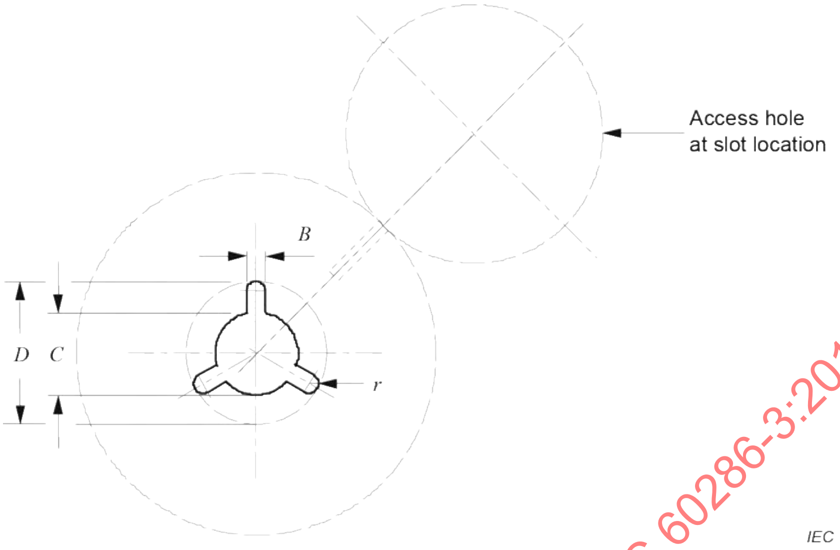


Figure 27 – Reel hole presentation

Table 25 – Reel hole dimensions

Dimensions in millimetres

~~Dimensions~~	
Symbols	**All types**
B	1,5 minimum
D	20,2 minimum
C	12,8 minimum
r	0,5 × *B*
For respective dimensional codes, see Figures 27.	

An adequate tape slot at the hub of the reel may be provided for the trailer. There should then also be a corresponding adequate access hole.

10.2 Marking

The reel shall provide space for a label. The label shall be placed on the outside of the flange opposite the round sprocket holes (see Figure 28).

The marking on the reel shall comply with the requirements of the detail specification of the component.

Further information may be given by normal script or in code form for automatic reading, for example, OCR, bar code, magnetic, etc.

In the case of bar codes, it is recommended that bar code 39 be used, as specified in ISO/IEC 16388. For optical character recognition (OCR), OCR B should be used.

11 Tape reeling requirements

11.1 All types

Tape with components ready for assembly placement shall be spooled in such a way that the round sprocket holes shall be on the left-hand side as the tape enters the feeder as viewed from the back of the feeder looking towards the bed of the assembly machine.

Tape with components shall wrap around the hub (see dimension N in Figure 26) without damage.

Component tapes shall be wound on reels suitable for feeding automatic mounting machines.

The mounting side of the components shall be oriented to the bottom side of the tape. The bottom side is defined as the invisible side of the tape when reeled (see Figure 28).

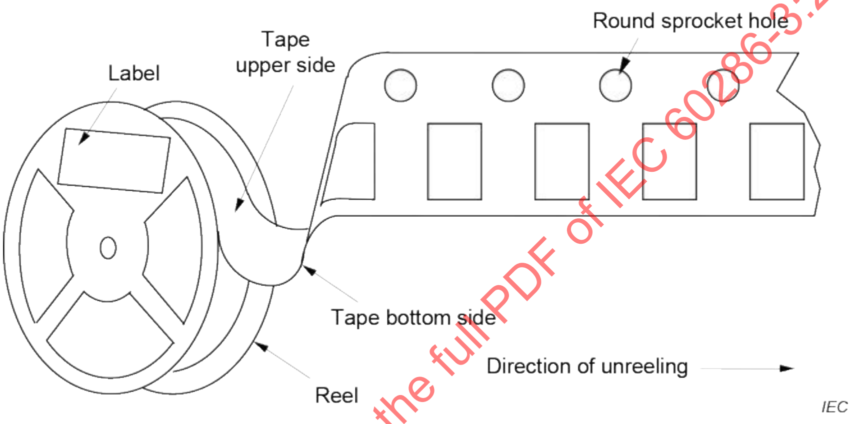


Figure 28 – Tape reeling and label area on the reel

11.2 Specific requirements for type 1a

Type 1a has effectively a cover tape on either side. If the mounting side needs to be reversed (as is the case for some surface-mounted components), then the tape shall be re-spooled and the alternate cover tape removed, to effectively invert the component.

11.3 Specific requirements for type 4

Generally, it is sufficient to wrap a layer of tape around the reel which normally comprises the leader for the tape, to protect the components in the tape. However, for additional protection or where the leader is insufficient, a static dissipative wrap may be wound around the completed reel.

11.4 Leader and trailer tape

11.4.1 General

For the leader and trailer, see 11.4.2, 11.4.3 and Figure 29.

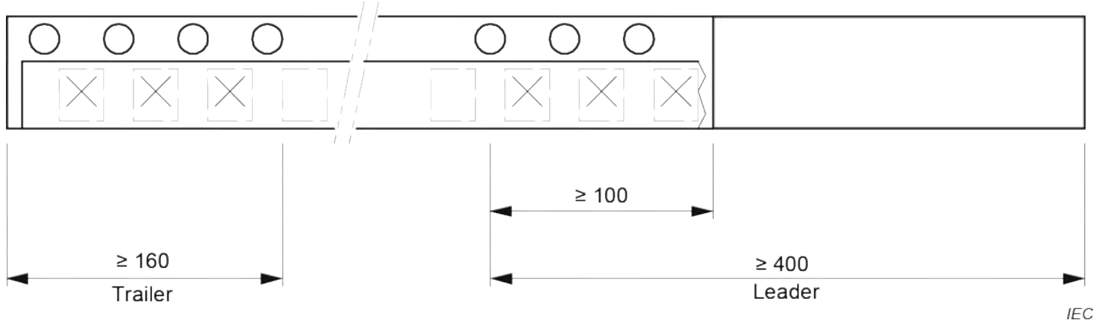


Figure 29 – Leader and trailer

11.4.2 Leader

For types 1a, 1b, 2a, 2b and 3 tapes, there shall be a leader of 400 mm minimum of cover tape, which includes at least 100 mm of carrier tape with empty compartments. All of the leader may consist of the carrier tape with empty compartments sealed by cover tape.

Type 4 tapes, which have no cover tape, shall include at least a leader of 100 mm of carrier tape with empty compartments.

11.4.3 Trailer

There shall be a trailer with a minimum of 160 mm carrier tape with empty compartments and sealed by the cover tape. The carrier tape shall be released from the reel hub as the last portion of the carrier tape unwinds from the reel.

11.5 Recycling

Tape and reels should be made of recyclable material. When such material is used in reels, a recycling symbol shall be marked on the reel.

ISO 11469 shall preferably be used for marking the material.

11.6 Missing components

The maximum number of missing components shall be 1 per reel or 0,025 %, whichever is greater.

There shall not be consecutive components missing from any reel for any reason.

Annex A
(normative)

Recommended measuring methods for type 1b

A.1 Measurement method for carrier tape thickness (T and T_3)

The equipment used to conduct these measurements shall be an external micrometer with a measuring pressure of 1,5 N or smaller. To measure the tape thickness at the cavity, including the puff, the probe shall be made of super-hard material with a recommended probe head diameter of 2,0 mm.

The thickness of the carrier tape shall be measured with an accuracy of 0,001 mm. The dimension of the thickness excluding the puff of the bottom of the cavity is T, when the flat side is measured adjacent to the round sprocket holes. The dimension of the thickness including the puff on the bottom of the cavity is T_3.

Measurement shall be made at the points shown in Figure A.1.

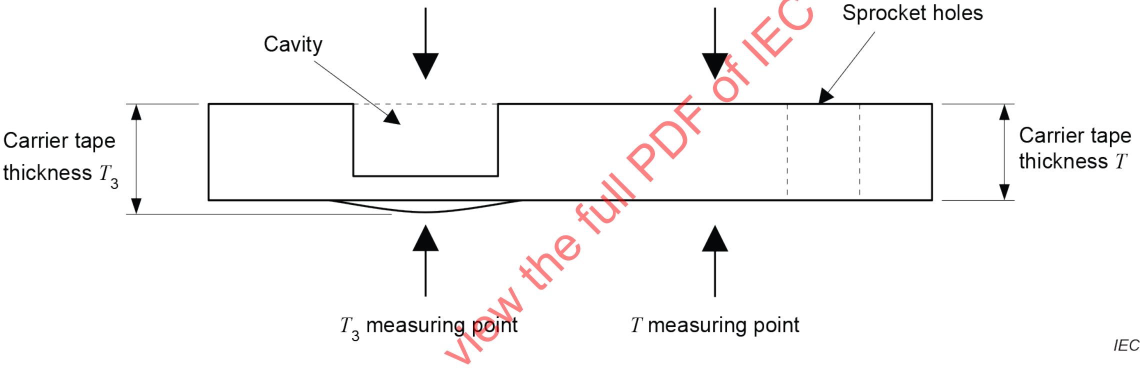


Figure A.1 – Carrier tape thickness measurement points

A.2 Measurement method for cavity (A_0 and B_0)

A measuring viewing scope with 10× magnification or more shall be used.

For dimensions A_0 and B_0, the minimum value including deformation of material shall be measured using an adequate light source to illuminate the surface of the tape and allow measurement of the features as shown in Figure A.2. Fluff should be excluded from the dimension.

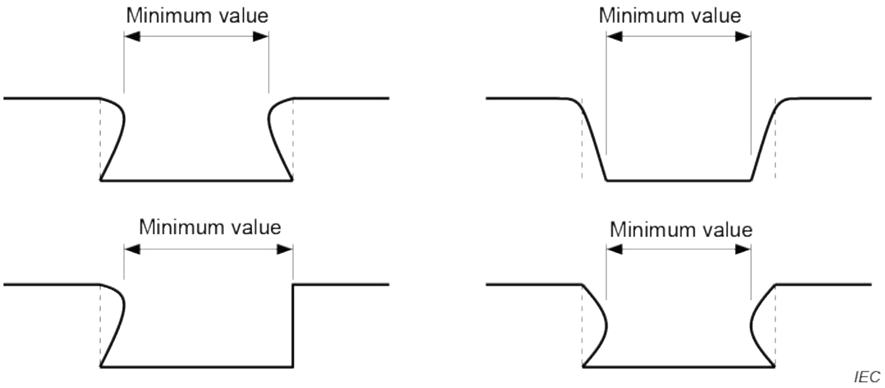


Figure A.2 – Cavity cross-section

A.3 Measurement method for cavity depth (dimension K_0)

The cavity depth K_0 should be the distance between the centre of the bottom of the cavity and the carrier surface at the centre point between the round sprocket hole and the cavity.

An example of a measurement of cavity depth K_0 is to use a non-contact measuring system to perform a measurement in accordance with Figure A.3.

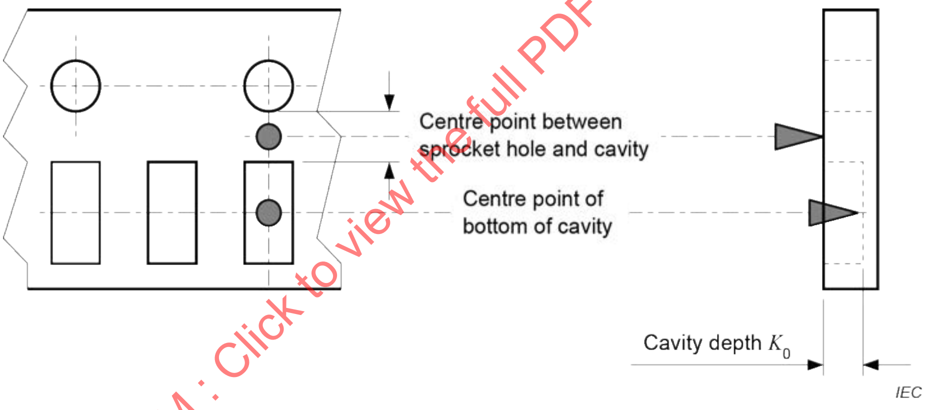


Figure A.3 – Cavity depth dimension

Bibliography

~~IEC 60286-3-1:2009, *Packaging of components for automatic handling – Part 3-1: Packaging of surface mount components on continuous tapes – Type V – Pressed carrier tapes*~~

~~IEC 60286-3-2:2009, *Packaging of components for automatic handling – Part 3-2: Packaging of surface mount components on continuous tapes – Type VI – Blister carrier tapes of 4 mm width*~~

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*

IEC TR 62258-3, *Semiconductor die products – Part 3: Recommendations for good practice in handling, packing and storage*

ISO/IEC 16388, *Information technology – Automatic identification and data capture techniques – Code 39 bar code symbology specification*

ISO 11469, *Plastics – Generic identification and marking of plastics products*

IEC 60286-3

Edition 6.0 2019-01

INTERNATIONAL STANDARD

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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

IEC 60286-3:2019-01(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

Part 3: Packaging of surface mount components on continuous tapes

FOREWORD

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International Standard IEC 60286-3 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This sixth edition cancels and replaces the fifth 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) addition of a table of the classification to symbols concerning tape, reel and common symbols;
b) additions of a figure of example of polarity and orientation and a figure of example of dot seal;
c) revision of requirements for camber;

d) addition of a definition of design value with regard to tilt.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
40/2643/FDIS	40/2649/RVD

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 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 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.

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 therefore print this document using a colour printer.

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.

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

Part 3: Packaging of surface mount components on continuous tapes

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

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

3 Terms, definitions and symbols

3.1 Terms and definitions

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

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

3.1.1
components
electronic part of a product that cannot be physically divided into smaller parts without losing its particular function

Note 1 to entry: This includes singulated die product.

Note 2 to entry: This is applied to all packaging-types for bare die products unless specifically mentioned otherwise.

3.1.2
component sizes
size of component that are identified with their metric size code

Note 1 to entry: This size code is followed by a capital M.

Note 2 to entry: To avoid possible confusion with inch-based size codes, an equivalency 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

3.1.3
packaging
product made of any material of any nature to be used for the containment, protection, structured alignment for automatic assembly, handling and delivery

3.1.4
pressed carrier tape
<type 1b> carrier tape with concave cavities formed by compression of the base material

3.1.5
fluff
<type 1b> fibre from the base material attached inside the cavity

Note 1 to entry: See Figure 1.

3.1.6
burr
<type 1b> surface projection of tape unintentially produced when cavity is formed

Note 1 to entry: See Figure 1.

3.1.7
deformation
<type 1b> bulge on the inner wall of the cavity

Note 1 to entry: See Figure 1.

3.1.8
puff
<type 1b> bulge on the reverse side of the cavity

Note 1 to entry: See Figure 1.

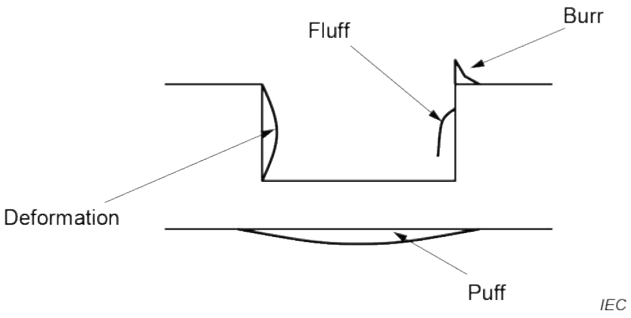


Figure 1 – Sectional view of component cavity (type 1b)

3.1.9
blister carrier tape
carrier tape which is identified as tape belonging to types 2a, 2b and 3

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

3.2 Symbols

The symbols used in this document are listed in Table 2.

Table 2 – Classification to symbols concerning tape, reel and common symbols

Symbols	Definitions	Figure references
A	Reel diameter	Figure 26
A_0	Cavity’s bottom dimension in direction of unreeling	Figures 2, 4, 5, 7, 8, 10, 11, 13, 14, 16 and 20
B	Reel hole key’s groove width	Figure 27
B_0	Cavity’s bottom dimension in direction of tape width	Figures 2, 4, 5, 7, 8, 10, 11, 13, 14, 16 and 20
B_1	Cavity’s rim in direction of tape width	Figures 8, 11 and 14
C	Reel hole diameter	Figures 26 and 27
C_T	Distance of puff under cavity in direction of tape width	Figure 5
d	Difference of diameter between sprocket hole and round foramen	Figure 14
D	Reel slot diameter	Figure 27
D_0	Sprocket hole diameter	Figures 2, 5, 8, 11, 14 and 17
D_1	Cavity’s bottom hole diameter	Figures 8 and 14
E_1	Shorter distance in direction of width between the origin point of round sprocket hole and the edge of a side of tape	Figures 2, 5, 8, 11, 14 and 17
E_2	Longer distance in direction of width between the origin point of round sprocket hole and the edge of a side of tape	Figures 2, 5, 8 and 11
F	Distance in direction of width between the origin point of round sprocket hole and the centre of cavity	Figures 2, 5, 8, 11 and 14
F_A	Distance in direction of width between the origin point of round sprocket hole and the centre of compartment	Figures 17, 19, 24 and 25
G	Shorter distance in direction of width between the cavity and the edge of a side of tape	Figures 2, 5, 8, 11 and 17
K_0	Cavity depth	Figures 2, 5, 8 ,11 ,14 and A.3
N	Hub diameter	Figure 26
P_0	Pitch of the sprocket holes	Figures 2, 3, 5, 6, 8, 9, 11, 14 and 17
P_1	Cavity pitch	Figures 2, 3, 5, 6, 8, 9, 11, 14, 17 and 18
P_2	Pitch between the centre of a cavity on the same line with the origin point of round sprocket hole and the centre of the next cavity in direction of unreeling	Figures 2, 3, 5, 6, 8, 9, 11 and 14
$P_{2\mathrm{A}}$	Pitch between the centre line of the origin point of round sprocket hole and the centre line of compartment in direction of unreeling	Figures 17, 18, 19, 24 and 25
P_3	Pitch between the centre of a cavity on the same line with the origin point of round sprocket hole and the centre of the second next cavity in direction of unreeling	Figures 3 and 6
P_4	Pitch between the centre of a cavity on the same line with the origin point of round sprocket hole and the centre of the third next cavity in direction of unreeling	Figures 3 and 6

Symbols	Definitions	Figure references
S	Sprocket hole pitch in direction of width	Figure 14
R	Bending radius of carrier tape	Figure 21
r	Curvature radius of reel hole key's groove	Figure 27
T	Carrier tape thickness without cover tape	Figures 2, 5, 8, 11, 14, 17, 25 and A.1
T_1	Top cover tape thickness or bottom cover tape thickness	Figures 2, 5, 8, 11, 14 and 17
T_2	Sum of outer cavity height and top cover tape thickness	Figures 8, 11 and 14
T_3	Thickenss of pressed carrier tape including bulge	Figures 5 and A.1
V_1	Compartment dimension in direcion of unreeling	Figures 17 and 18
V_2	Compartment dimension in direction of width	Figures 17 and 18
W	Carrier tape width	Figures 2, 5, 8, 11, 14 and 17
W_P	Distance between adhesive tapes	Figure 17
W_1	Reel inner width(measured at hub)	Figure 26
W_2	Reel overall width	Figure 26
W_3	Reel inner width in the rim	Figure 26
Z	Component thickness	Figure 25

4 Structure of the specification

The various types of tapes are as follows.

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)

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)

5 Dimensional requirements for taping

5.1 Component cavity positioning requirements

5.1.1 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 (see Figures 2, 5, 8, 11 and 14). 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 (see Figures 3, 6, 9 and 12).

5.1.2 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 (see Figure 17). 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 25, 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.

5.2 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.

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

For respective dimensional codes, see Figures 2 to 4 and Tables 3 to 5.

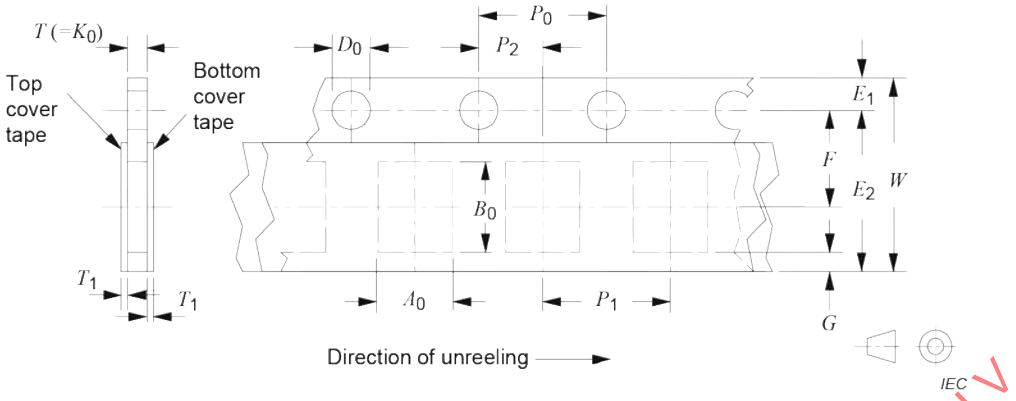
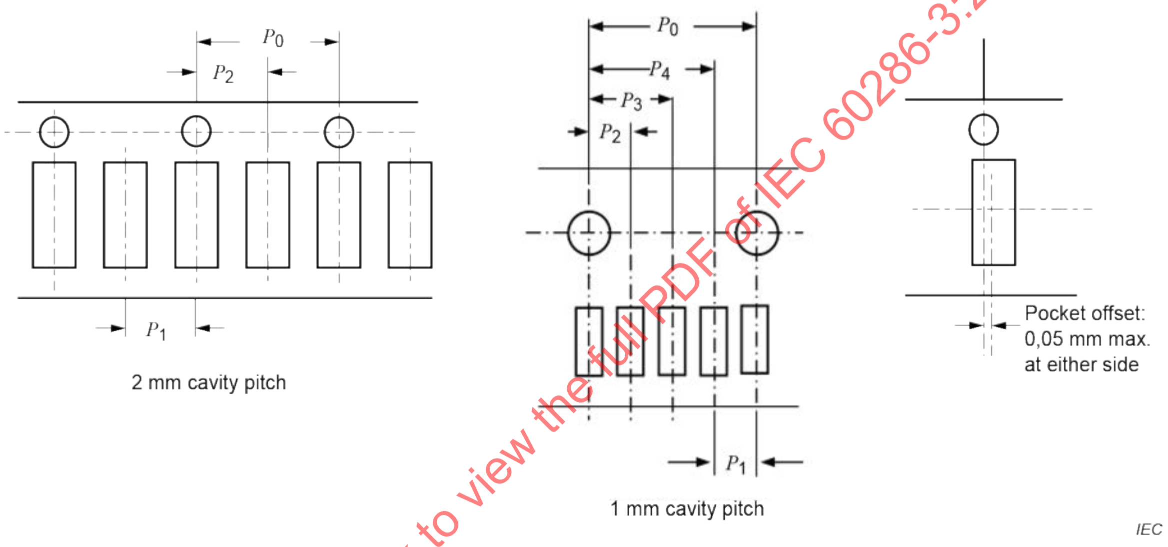


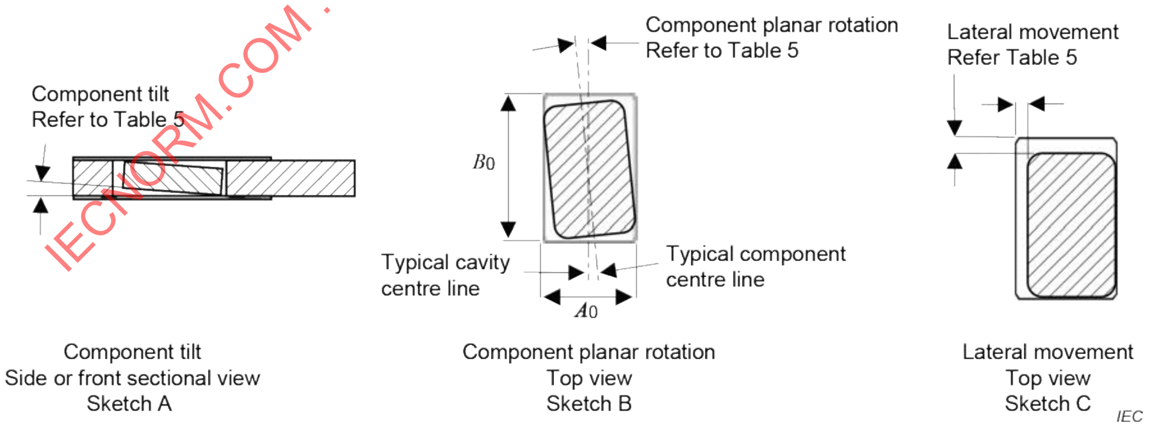
Figure 2 – 8 mm and 12 mm punched carrier-tape dimensions (4 mm cavity pitch)



2 mm cavity pitch

1 mm cavity pitch

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



Component tilt
Side or front sectional view
Sketch A

Component planar rotation
Top view
Sketch B

Lateral movement
Top view
Sketch C

Figure 4 – Maximum component tilt, rotation and lateral movement

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

Dimensions in millimetres

Tape size	D_0	E_1	P_0	G min.	T max.	T_1 (each T_1)	P_0 pitch cumulative tolerance
8 and 12	$1{,}5^{+0{,}1}_{0}$	1,75 ± 0,1	4,0 ± 0,1 ($P_1 \geq 4$) 4,0 ± 0,05 ($P_1 = 2$, $P_1 = 1$)	0,75	1,1 paper[a] 1,6 non-paper	0,1 maximum	± 0,2 / 10 pitches

For respective dimensional codes, see Figure 2.

[a] The paper is the material of the punched carrier tape.

Table 4 – Variable dimensions of 8 mm and 12 mm punched carrier tape

Dimensions in millimetres

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 ± 0,05	1,0 ± 0,05 ($P_1 = 1$) 2,0 ± 0,05 ($P_1 = 2$) 4,0 ± 0,1 ($P_1 = 4$)	1,0 ± 0,05 ($P_1 = 1$) 2,0 ± 0,05 ($P_1 = 2$) 2,0 ± 0,05 ($P_1 = 4$)	2,0 ± 0,05 ($P_1 = 1$)	3,0 ± 0,05 ($P_1 = 1$)	$8{,}0^{+0{,}3}_{-0{,}1}$	See 5.2
12	10,25	5,5 ± 0,05	2,0 ± 0,05 ($P_1 = 2$) 4,0 ± 0,1 ($P_1 \geq 4$)	2,0 ± 0,05	–	–	$12{,}0^{+0{,}3}_{-0{,}1}$	

For respective dimensional codes, see Figures 2 to 4.

Table 5 – Component tilt, planar rotation and lateral movement

Tape size mm	Component tilt (design value) [a]	Component planar rotation (design value) [a]	Lateral movement mm
8 and 12	10° maximum	20° maximum	0,3 maximum (P_1 = 1, P_1 = 2) 0,5 maximum (P_1 ≥ 4)

For respective dimensional codes, see Figure 4.

The trend for allowed component planar rotation of components with either length or width less than 1,2 mm is 10° maximum.

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.

When handling bare die products in tape size 8 mm, the lateral movement of 0,1 mm maximum for either cavity dimension should be allowed.

When handling bare die products in tape size 12 mm, the lateral movement of 0,15 mm maximum for either cavity dimension should be allowed.

[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.

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

For respective dimensional codes, see Figures 5 to 7 and Tables 6 to 8.

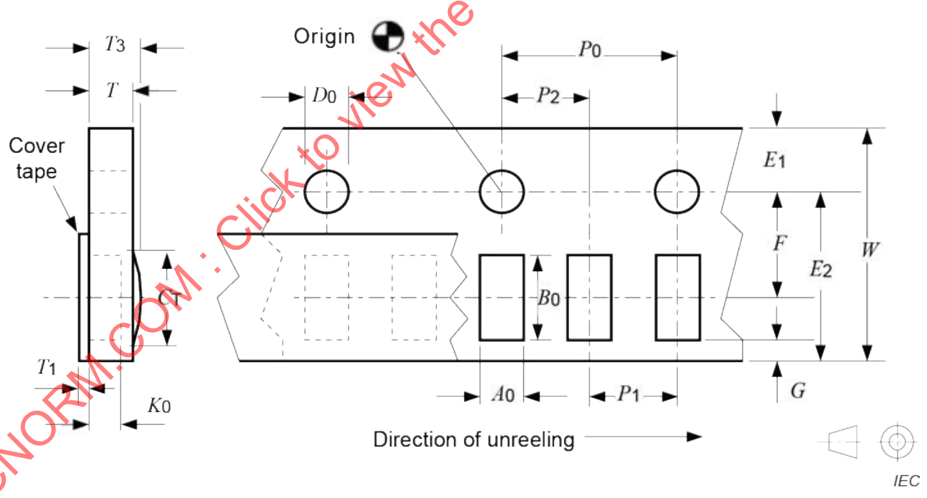
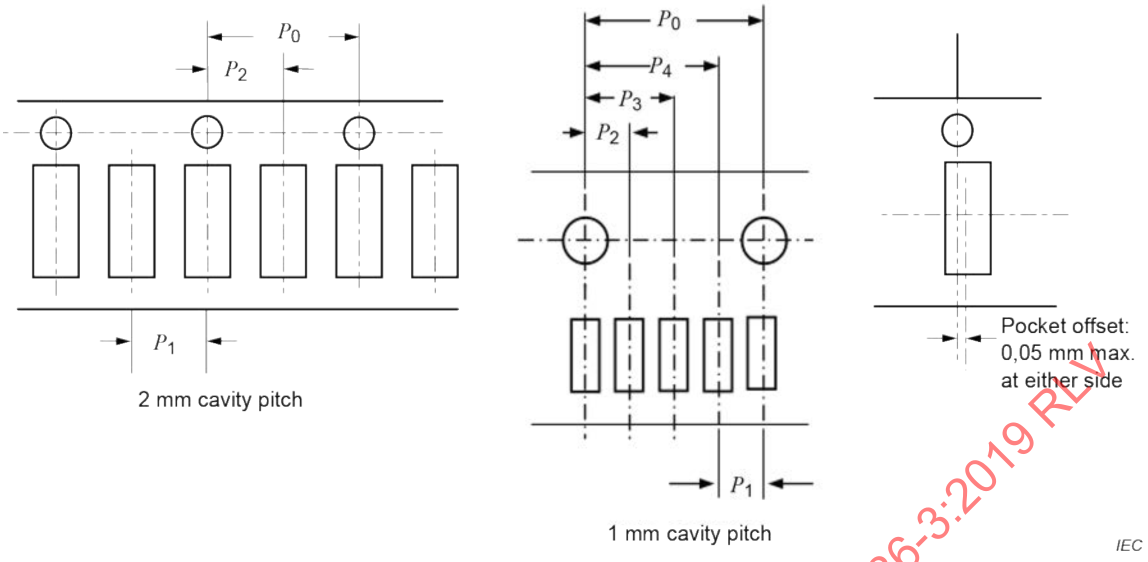


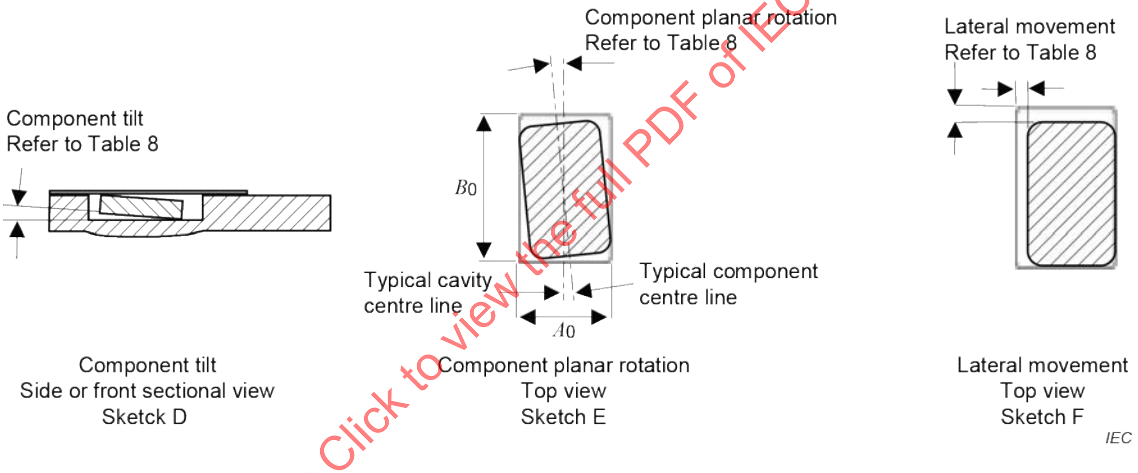
Figure 5 – Dimensions (P_0 = 4 mm/P_1 = 2 mm) and (P_0 = 4 mm/P_1 = 1 mm)



2 mm cavity pitch

1 mm cavity pitch

Figure 6 – Illustration of 2 mm and 1 mm cavity pitch and maximum pocket offset



Component tilt
Side or front sectional view
Sketck D

Component planar rotation
Top view
Sketch E

Lateral movement
Top view
Sketch F

Figure 7 – Maximum component tilt, rotation and lateral movement

Table 6 – Constant dimensions of 8 mm pressed carrier tape

Dimensions in millimetres

Tape size	D_0 [a]	E_1	G min.	P_0	T max.	T_1 max.	T_3-T [b] max.	P_0 **pitch cumulative tolerance**
8	$1{,}5\,^{+0{,}1}_{0}$	1,75 ± 0,1	0,75	4,0 ± 0,1	1,1	0,1	0,1	± 0,1 / 10 pitches

For respective dimensional codes, see Figures 5 and 6.

[a] If positioning precision is required, for example when components ≤ size 1005M are mounted in a narrow space, then the tolerance on D_0 should be +0,05 / −0,00 mm.

[b] For components with size designation of 1005M or smaller, the puff ($T_3 - T$) should be limited to 0,05 mm maximum.

Table 7 – Variable dimensions of 8 mm pressed carrier tape

Dimensions in millimetres

Tape size	C_T max.	E_2 min.	F	P_1	P_2	P_3	P_4	W	A_0, B_0, K_0
8	4,35	6,25	3,5 ± 0,05	1,0 ± 0,05 (P_1 = 1) 2,0 ± 0,05 (P_1 = 2) 4,0 ± 0,1 (P_1 = 4)	1,0 ± 0,05 (P_1 = 1) 2,0 ± 0,05 (P_1 = 2) 2,0 ± 0,05 (P_1 = 4)	2,0 ± 0,05 (P_1 = 1)	3,0 ± 0,05 (P_1 = 1)	$8{,}0^{+0{,}3}_{-0{,}1}$	See 5.2

For respective dimensional codes, see Figures 5 to 7.

Table 8 – Component tilt, planar rotation and lateral movement

Tape size mm	**Component tilt** **(design value)** [a]	**Component planar rotation** **(design value)** [a]	**Lateral movement** mm
8	20° maximum	20° maximum	0,12 maximum (Component size ≤ 0603M) 0,20 maximum (Component size 1005M) 0,30 maximum (Component size ≥ 1608M)

For respective dimensional codes, see Figure 7.

[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.

5.5 Type2a – 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)

For respective dimensional codes, see Figures 8 to 10 and Tables 9 to 11.

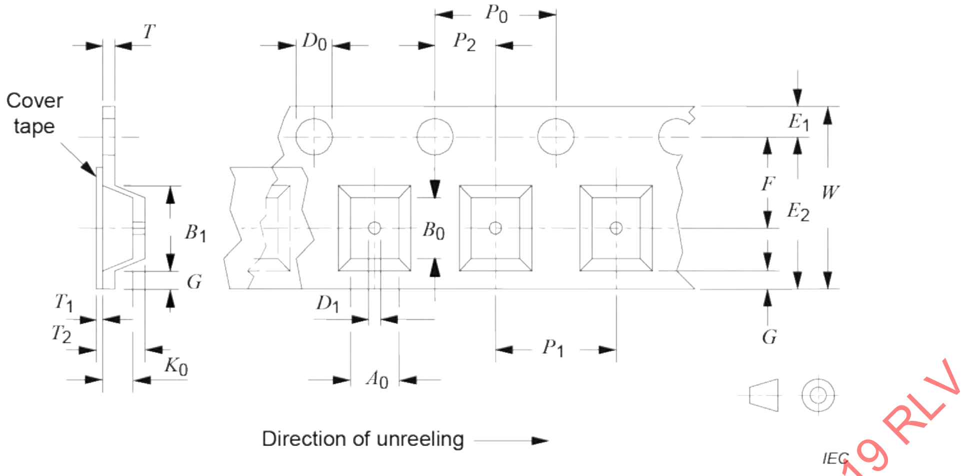


Figure 8 – Blister carrier tape dimensions (8 mm, 12 mm, 16 mm and 24 mm)

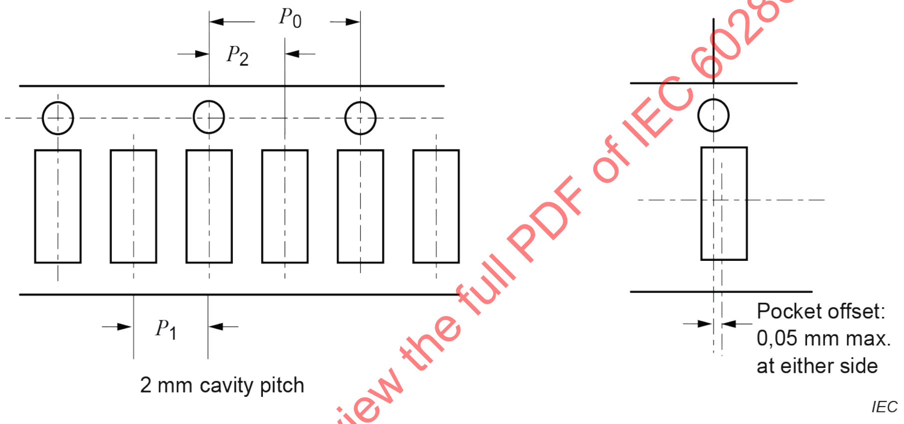


Figure 9 – Illustration of 2 mm cavity pitch and pocket offset

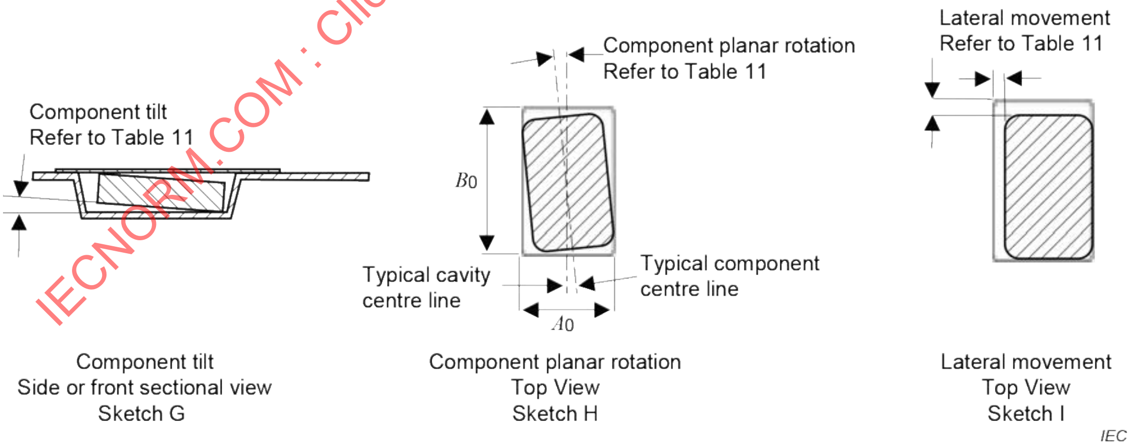


Figure 10 – Maximum component tilt, rotation and lateral movement

Table 9 – Constant dimensions of 8 mm to 24 mm blister carrier tape

Dimensions in millimetres

Tape size	D_0	E_1	G min.	P_0	T max.	T_1 max.	P_0 pitch cumulative tolerance
8 to 24	$1{,}5^{+0{,}1}_{0}$	1,75 ± 0,1	0,75	4,0 ± 0,1 ($P_1 \geq 4$) 4,0 ± 0,05 ($P_1 = 2$)	0,6	0,1	±0,2 / 10 pitches

For respective dimensional codes, see Figures 8 and 9.

Table 10 – Variable dimensions of 8 mm to 24 mm blister carrier tape

Dimensions in millimetres

Tape size	B_1 max.	D_1 [a] min.	E_2 min.	F	P_1	P_2	T_2 max.	W	A_0, B_0, K_0
8	4,35	0,3	6,25	3,5 ± 0,05	2,0 ± 0,05 4,0 ± 0,1	2,0 ± 0,05	3,5	$8{,}0^{+0{,}3}_{-0{,}1}$	See 5.2
12	8,2	1,5	10,25	5,5 ± 0,05	2,0 ± 0,05 4,0 ± 0,1 to 12,0 ± 0,1 in 4,0 increments	2,0 ± 0,05	6,5	$12{,}0^{+0{,}3}_{-0{,}1}$	
16	12,1	1,5	14,25	7,5 ± 0,1	4,0 ± 0,1 to 16,0 ± 0,1 in 4,0 increments	2,0 ± 0,1	9,5	$16{,}0^{+0{,}3}_{-0{,}1}$	
24	20,1	1,5	22,25	11,5 ± 0,1	4,0 ± 0,1 to 24,0 ± 0,1 in 4,0 increments	2,0 ± 0,1	12,5	$24{,}0^{+0{,}3}_{-0{,}1}$	

For respective dimensional codes, see Figures 8 to 10.

[a] Optionally, for easy and reliable removal of the component, or for component inspection or for any applicable application, the cavity may have a hole in the centre of the bottom.

Table 11 – Component tilt, rotation and lateral movement

Tape size mm	Component tilt (design value) [a]	Component planar rotation (design value) [a]	Lateral movement mm
8, 12	10° maximum	20° maximum	0,5 maximum
16, 24	10° maximum	10° maximum	0,5 maximum

For respective dimensional codes, see Figure 10.

The trend for allowed component planar rotation of components with either length or width less than 1,2 mm is 10° maximum.

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.

When handling bare die products in tape size 8 mm, the lateral movement of 0,1 mm maximum for either cavity dimension should be allowed.

When handling bare die products in tape size 12 mm, the lateral movement of 0,15 mm maximum for either cavity dimension should be allowed.

[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.

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

For respective dimensional codes, see Figures 11 to 13 and Tables 12 to 14.

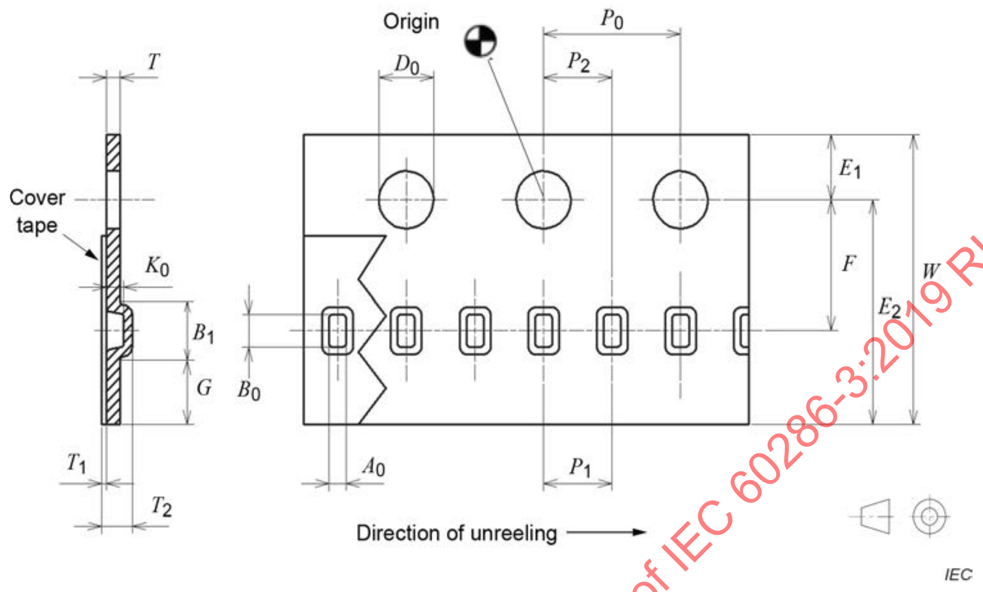


Figure 11 – Type 2b carrier tape

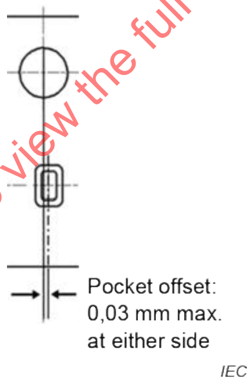
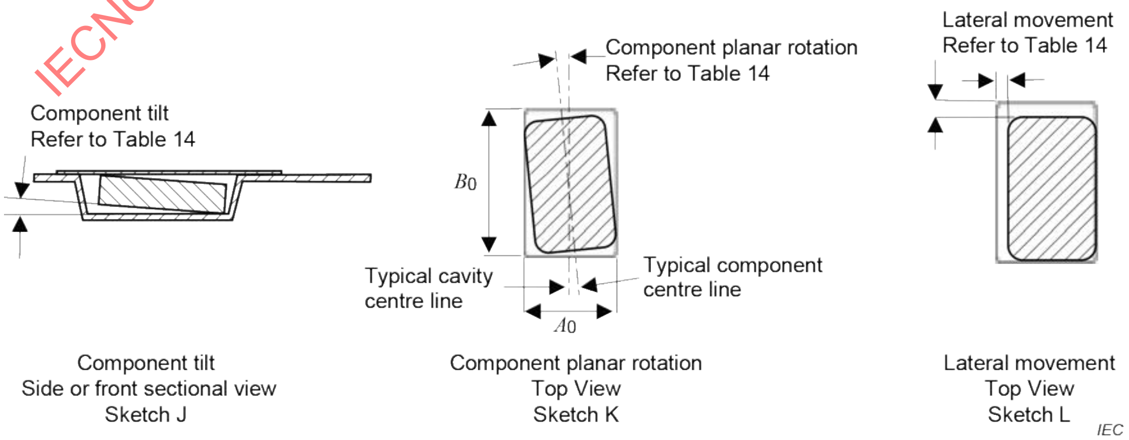


Figure 12 – Maximum pocket offset



Component tilt
Side or front sectional view
Sketch J

Component planar rotation
Top View
Sketch K

Lateral movement
Top View
Sketch L

Figure 13 – Maximum component tilt, rotation and lateral movement

Table 12 – Constant dimensions of 4 mm carrier tape

Dimensions in millimetres

Tape size	D_0	E_1	G min.	P_0	T min.	T max.	T_1 max.	**P_0 pitch cumulative tolerance**
4	0,80 ± 0,04	0,90 ± 0,05	0,50	2,00 ± 0,04	0,15	0,40	0,08	±0,1 / 20 pitches

For respective dimensional codes, see Figure 11.

Table 13 – Variable dimensions of 4 mm carrier tape

Dimensions in millimetres

Tape size	B_1 max.	E_2 min.	F	P_1	P_2	T_2 max.	W	A_0, B_0, K_0
4	1,48 [a]	3,07	1,8 ± 0,03	1,0 ± 0,03	1,0 ± 0,03	1,1	4,0 ± 0,08	See 5.2

For respective dimensional codes, see Figures 11 and 13.

[a] Reference dimension.

Table 14 – Component tilt, planar rotation and lateral movements

Tape size mm	**Component tilt (design value)** [a]	**Component planar rotation (design value)** [a]	**Lateral movement** mm
4	20° maximum	20° maximum	0,10 maximum (Component size 0402M) 0,12 maximum (Component size 0603M) 0,20 maximum (Component size > 0603M)

For respective dimensional codes, see Figure 13.

[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.

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

For respective dimensional codes, see Figures 14 to 16 and Tables 15 to 17.

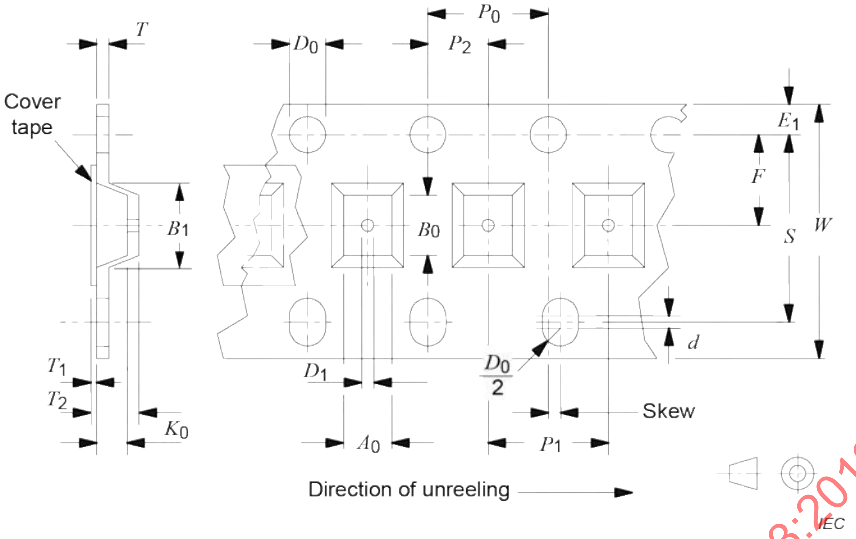


Figure 14 – Blister carrier tape

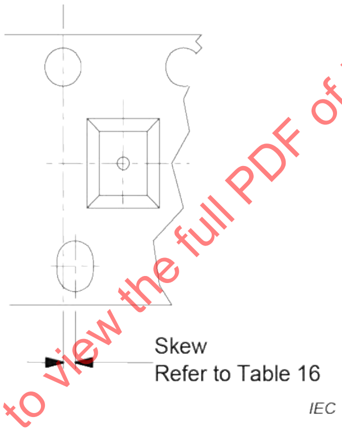
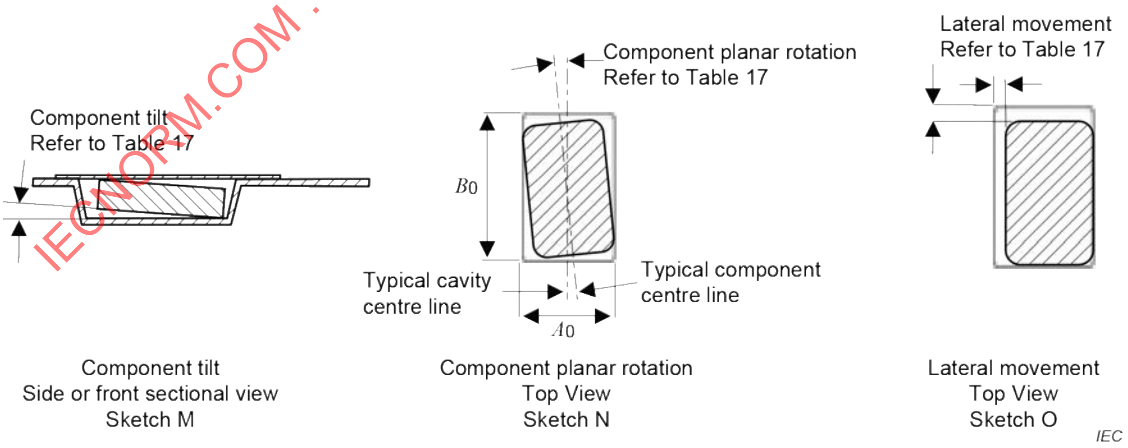


Figure 15 – Elongated sprocket hole skew



Component tilt
Side or front sectional view
Sketch M

Component planar rotation
Top View
Sketch N

Lateral movement
Top View
Sketch O

Figure 16 – Maximum component tilt, rotation and lateral movement

Table 15 – Constant dimensions of 32 mm to 200 mm blister carrier tape

Dimensions in millimetres

Tape size	D_0	D_1 [a] min.	d	E_1	P_0	T max.	T_1 max.	P_0 pitch cumulative tolerance
32 to 200	$1{,}5^{+0{,}1}_{0}$	2,0	0,2 ± 0,05	1,75 ± 0,1	4,0 ± 0,1	1,0	0,1	±0,2 / 10 pitches

For respective dimensional codes, see Figure 14.

[a] Optionally, for easy and reliable removal of the component from the compartment of the tape by automatic pick-up equipment, the cavity may have a hole in the centre of the bottom.

Table 16 – Variable dimensions of 32 mm to 200 mm blister carrier tape

Dimensions in millimetres

Tape size	B_1 max.	F	P_1	P_2	S	Skew max.	T_2 max.	W	A_0, B_0, K_0
32	23,0	14,2 ± 0,1	4,0 ± 0,1 to 32,0 ± 0,1 in 4,0 increments	2,0 ± 0,1	28,4 ± 0,1	0,05	12,5	32,0 ± 0,3	See 5.2
44	35,0	20,2 ± 0,1	4,0 ± 0,1 to 44,0 ± 0,1 in 4,0 increments	2,0 ± 0,15	40,4 ± 0,1		16,0	44,0 ± 0,3	
56	46,0	26,2 ± 0,1	4,0 ± 0,1 to 56,0 ± 0,1 in 4,0 increments	2,0 ± 0,15	52,4 ± 0,1		20,0	56,0 ± 0,3	
72	60,0	34,2 ± 0,30	4,0 ± 0,15 to 72,0 ± 0,15 in 4,0 increments	2,0 ± 0,2	68,4 ± 0,1	0,1	30,0	72,0 −0,3/ +0,4	
88	76,0	42,2 ± 0,30			84,4 ± 0,1			88,0 −0,3/ +0,4	
104	91,0	50,2 ± 0,35	4,0 ± 0,20 to 72,0 ± 0,20 in 4,0 increments	2,0 ± 0,25	100,4 ± 0,2	0,15	35,0	104,0 −0,3/ +0,5	
120	107,0	58,2 ± 0,35			116,4 ± 0,2		40,0	120,0 −0,3/ +0,5	
136	123,0	66,2 ± 0,40	4,0 ± 0,25 to 72,0 ± 0,25 in 4,0 increments	2,0 ± 0,3	132,4 ± 0,2			136,0 −0,3/ +0,5	
152	139,0	74,2 ± 0,40			148,4 ± 0,3			152,0 −0,3/ +0,6	
168	153,0	82,2 ± 0,45	4,0 ± 0,30 to 72,0 ± 0,30 in 4,0 increments	2,0 ± 0,35	164,4 ± 0,3	0,2		168,0 −0,3/ +0,6	
184	169,0	90,2 ± 0,45			180,4 ± 0,3			184,0 −0,3/ +0,6	
200	185,0	98,2 ± 0,50	4,0 ± 0,35 to 72,0 ± 0,35 in 4,0 increments	2,0 ± 0,4	196,4 ± 0,3			200,0 −0,3/ +0,6	

For respective dimensional codes, see Figures 14 and 15.

Table 17 – Component tilt, planar rotation and lateral movements

Tape size mm	Component tilt (design value) [a]	Component planar rotation (design value) [a]	Lateral movement mm
32, 44, 56	10° maximum	10° maximum	1,0 maximum
72 to 200	5° maximum	10° maximum	1,0 maximum

For respective dimensional codes, see Figure 16.

[a] A design value is a calculated value for design purposes only. For example, component tilt is not intended to be measured, but is intended to be the calculated value for the pocket design of a carrier tape.

5.8 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)

For respective dimensional codes, see Figures 17 to 19 and Tables 18 to 20. Type 4 carrier is designed specifically for automated handling of components, such as singulated bare die. Components are placed on an adhesive film in compartments. The compartment is defined by dimensions V_1 and V_2, which are virtual boundaries of maximum practical sizes that enable use of a multiple of component footprints. The boundaries shall not be used as fiducials for component placement during taping. Refer to 9.4.2 for component positioning and lateral placement.

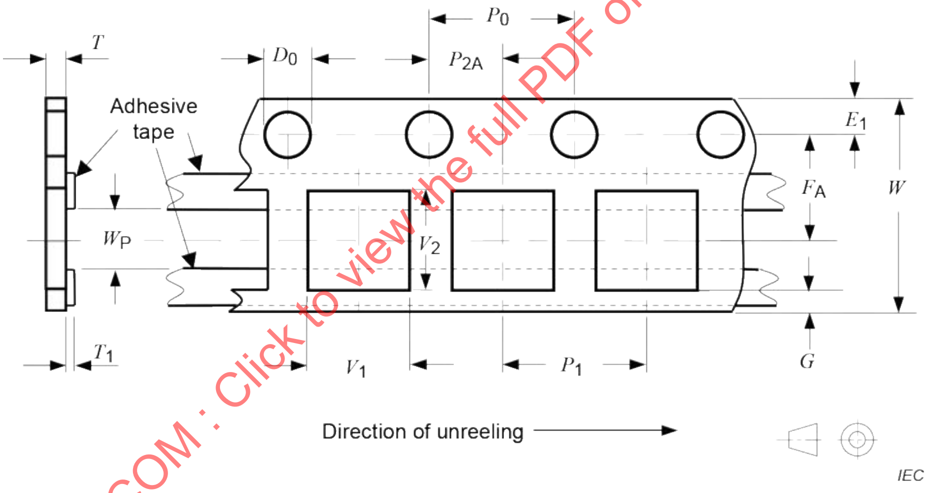


Figure 17 – Adhesive-backed punched carrier-tape dimensions (4 mm compartment pitch)

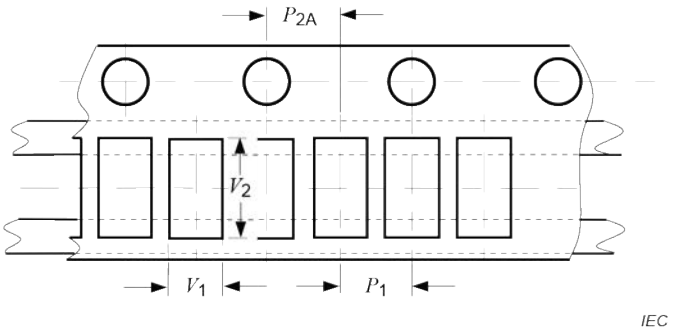


Figure 18 – Illustration of 2 mm compartment pitch

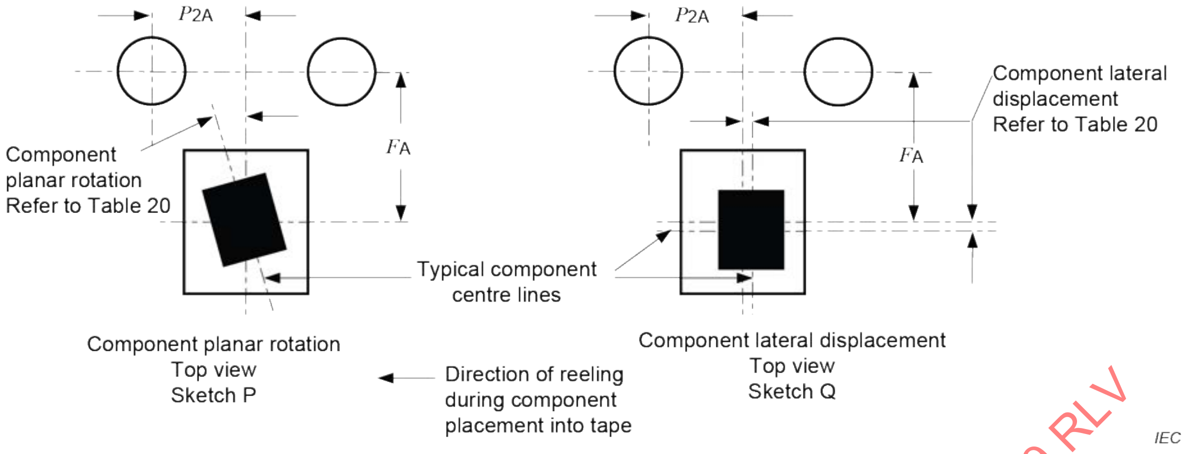


Figure 19 – Maximum component planar rotation and lateral displacement

Table 18 – Dimensions of adhesive backed punched carrier tape

Dimensions in millimetres

Tape size	D_0	E_1	P_0	P_{2A}	T_1 max.	G min.	T max.	W_P	P_0 **pitch cumulative tolerance**
8, 12, 16, 24	$1{,}5^{+0{,}05}_{0}$	1,75 ± 0.1	4,0 ± 0,025	2,0 ± 0,05 (W = 8 and 12) 2,0 ± 0,1 (W = 16 and 24)	0,1	0,75	1,1	See [a, b, c]	± 0,2 / 10 pitches

For respective dimensional codes, see Figures 17 to 19.

[a] Gap W_P is optional and is defined together with the end-user. W_P is determined from the component specifications (dimension B and surface terrain). Its purpose is to

a) minimize adhesion of the component to optimize consistent retrieval at the pick point. This is especially important with components having a surface contact area of 10 mm^2 or greater with the adhesive film;

b) secure retention of component in compartment during reeling/unreeling.

[b] Gap W_P is typically ≤ (0,5 × component dimension in the direction of V_2).

[c] Gap W_P is centered along the F_A centerline.

Table 19 – Variable dimensions of adhesive-backed punched carrier tape

Dimensions in millimetres

Tape size	F_A	P_1	V_1	V_2	W
8	3,50 ± 0,05	2,0 ± 0,05 4,0 ± 0,1	1,5	3,1	$8{,}0^{+0{,}2}_{-0{,}1}$
			3,1	3,1	
12	5,50 ± 0,05	2,0 ± 0,05 4,0 ± 0,1 to 12,0 ± 0,1 in 4,0 increments	1,5	6,35	$12{,}0^{+0{,}2}_{-0{,}1}$
			3,1	6,35	
			6,35	6,35	
16	7,50 ± 0,05	4,0 ± 0,1 to 16,0 ± 0,1 in 4,0 increments	6,35	10,2	$16{,}0^{+0{,}2}_{-0{,}1}$
			10,2	10,2	
24	11,50 ± 0,05	4,0 ± 0,1 to 24,0 ± 0,1 in 4,0 increments	10,2	17,3	$24{,}0^{+0{,}2}_{-0{,}1}$
			14,0	17,3	

For respective dimensional codes, see Figures 17 to 19.

NOTE Dimension E_2, as defined in tape types 1a, 1b, 2a and 2b, is for type 4 tape minimum value only, but can be derived as a reference dimension by subtracting E_1 from W (maximum).

Table 20 – Component planar rotation and lateral displacement

Tape size mm	Component planar rotation	Component lateral displacement mm
8, 12, 16 and 24	5° maximum	0,05 maximum (P_1 = 2) 0,1 maximum (P_1 = 4)

For respective dimensional codes, see Figure 19.

6 Polarity and orientation requirements of components in the tape

6.1 Requirements for all tape types

For all tape types, the following requirements apply.

a) All polarized components shall be oriented in one direction. For components with two terminations, the cathode side shall be either adjacent to the round sprocket hole or the last one to leave the package, unless otherwise specified in the detail specification.

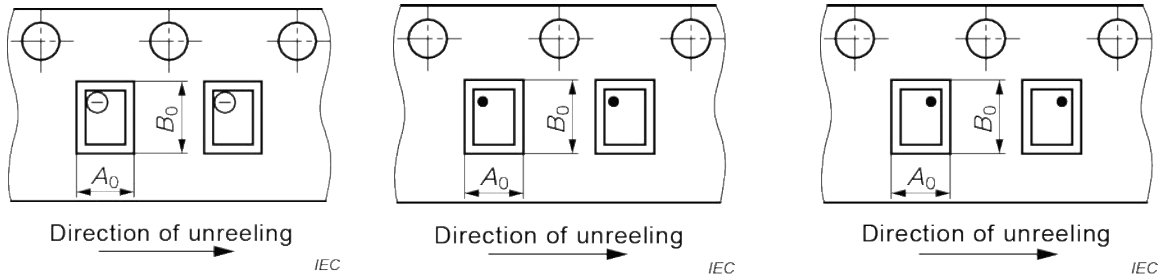
b) For components in flat packages (for example, chip carriers and SO-packages) with more than two terminations, termination No. 1 shall be adjacent to the round sprocket hole, unless otherwise specified in the detail specification.

c) For die products (bare die or bumped die) with more than two pads or terminations, pad No. 1 shall be located on the side adjacent to the round sprocket hole, unless otherwise specified in the detail specification.

d) For components with a lead configuration corresponding to IEC 60191-2, the component side from which one single termination emerges shall be at the compartment side closest to the round sprocket holes in the tape and the mounting side shall face the bottom of the component compartment.

e) For quartz-crystal units with two terminations located on one side of the package, the terminations shall be located at the round sprocket hole side.

f) The polarity or orientation of components with other shapes or termination configurations shall be stated in the detail specification.



a) Cathode is in the upper left

b) Termination No.1 is in the upper left

c) Termination No.1 is in the upper right

The graphical symbol "-", which stands for the position of the cathode side, is shown in a). The mark "●", which stands for the position of termination No.1, is shown in b). Another position of termination No.1 is shown in c), where the position cannot be settled as in b).

Figure 20 – Example of polarity and orientation

6.2 Specific requirements for type 1a

Type 1a has effectively a cover tape on either side. Therefore, components may be placed with the mounting side orientated to the bottom or the top side of the tape (for the bottom side of the tape, see 11.1). If the mounting side needs to be reversed (as is the case for some surface-mounted components), then the tape is re-spooled and the alternate cover tape removed, effectively inverting the component.

6.3 Specific requirements for type 4

The non-active side of the component is generally placed at the bottom side of the tape, i.e. affixed to the adhesive layer. This orientation enables additional visual inspection and probe testing 'in-situ', within an open compartment, since a cover tape is not required for component retention. In the case of flip-chips or WLCSP, the component may be placed 'bumps down' on a special adhesive layer designed for that purpose. Bumps down orientation, on adhesive tape, protects the bumps from damage attributable to abrasion or mechanical handling.

7 Carrier tape requirements

7.1 Taping materials

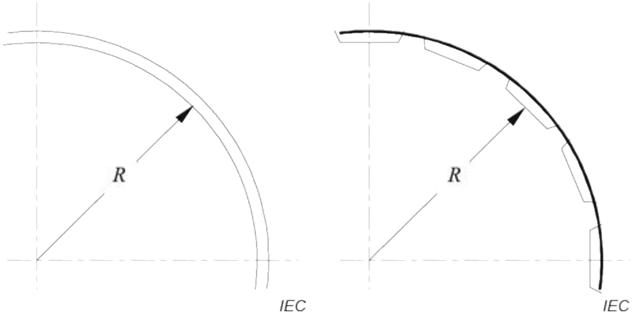
Taping materials and techniques shall be selected to avoid damage to electrostatic-sensitive components.

7.2 Minimum bending radius (for all types)

When the tape is bent with the minimum radius (measured at the bottom side of the tape, see Figure 21) given for a particular tape width as indicated in Table 21, the tape shall not be damaged and the components shall maintain their position and orientation in the tape.

Tape material should have such properties that without additional assistance the material can easily bend to the radius specified in Table 21. Otherwise, the tape cannot be handled anymore.

Tape with components shall pass around the radius R specified in Table 21 without damage.



Punched tape Blister tape

Figure 21 – Bending radius

Table 21 – Minimum bending radius

Dimensions in millimetres

W	P_1	R min.	
		Types 1a, 1b, 2a, 2b and 3	**Type 4 only** [b]
4	1	25	25
8	1/2/4	25	25
12	2/4/8	30[a]	50
16	4/8/12/16	30	50
24	4/8/12	30	50
24	16/24	30	89
32	4 to 32	40	n/a
44	4 to 44	40	n/a
56	4 to 56	50	n/a
72 to 200	4 to 72[b]	75	n/a

n/a Not applicable.

[a] For punched tapes, the minimum bending radius shall be 25 mm.

[b] The minimum bending radius for the tape with components is proportional to the component dimension in the V_1 direction of the carrier tape compartment. A minimum bending radius of 100 mm is recommended for 24 mm tapes containing singulated bare die when the component/compartment pitch P_1 (Figure 17) is 16 mm. When required, a length of carrier tape trailer can be spooled on the reel to increase effective reel hub diameter N (Figure 26).

7.3 Camber

The camber shall be measured with the carrier tape passed between two plates and without tension applied to the tape. To measure camber accurately, both left and right edges of the 250-mm carrier tape shall be in contact with the straight edge. Measure the largest camber between two edges of the tape in accordance with Figure 22. The camber shall not exceed 1 mm over 250 mm in either direction, unless otherwise specified in the relevant specification.

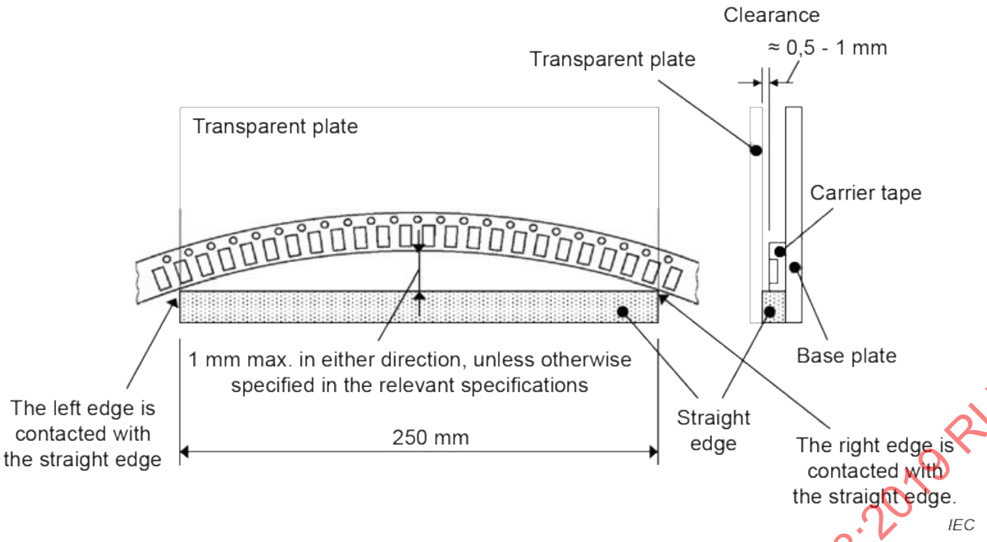


Figure 22 – Measuring method and camber

8 Cover tape requirements (for types 1a, 1b, 2a, 2b and 3)

For tape types 1a, 1b, 2a, 2b and 3 the following cover tape requirements apply.

a) The cover tapes shall not cover the round sprocket holes (types 1a, 1b, 2a, 2b and 3) and elongated sprocket holes (type 3).

b) The adhesive and material of the cover tape shall not adversely affect the mechanical and electrical characteristics and the marking of the components.

c) Components shall not stick to the carrier tape or to the cover tape.

d) The cover tape(s) shall not become detached.

e) The cover tape(s) shall not protrude beyond the edge of the tape.

f) The cover tape shall not be attached to the carrier tape on the surface between two adjacent component pockets.

An exception may apply in those cases where thin components, during reeling or de-reeling, can slide from pocket to pocket. In these cases, the surface between two adjacent pockets may be dot sealed according the peel force requirements (see Figure 23).

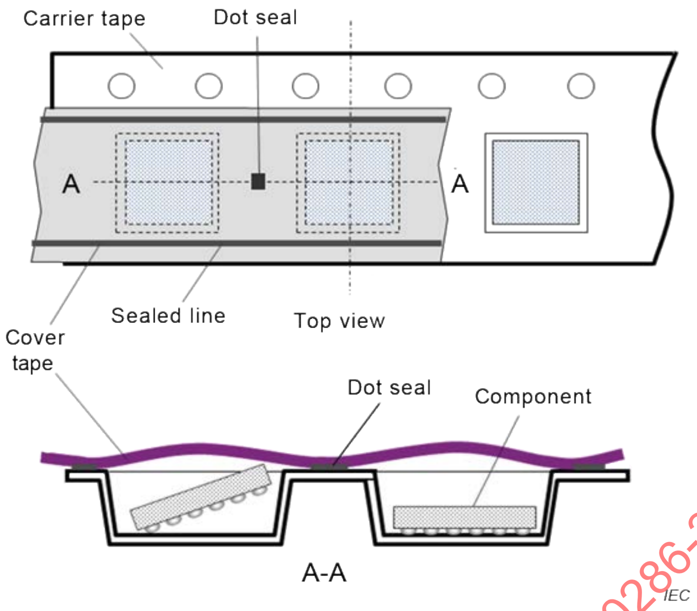


Figure 23 – Dot seals for thin components (as exceptions)

g) The break force of the cover tape shall be 10 N min.

h) The angle at the peel strength test between the cover tape during peel-off and the direction of unreeling shall be 165° to 180°. The cover tape shall adhere uniformly to the carrier tape along both sides in the direction of unreeling.

i) The peel force with a peel speed of 300 mm/min ± 10 mm/min shall be as indicated in Table 22.

Table 22 – Peel force

Tape width W	**Peel force**
4 mm	0,1 N to 0,7 N
8 mm	0,1 N to 1,0 N
12 mm to 56 mm	0,1 N to 1,3 N
72 mm to 200 mm	0,1 N to 1,5 N
Tape types 1a, 1b and 2b: For ultra small components 0603M size or smaller, the mass is so light that components may run-off from the component compartment when the cover tape is peeled. For these component sizes it is recommended to use a peel force of 0,2 N ± 0,1 N and, as aging may have an effect on the peel force, this peel force should be valid for at least 7 days after sealing. Unless specifically requested by the end-user, the sale of tapes shall not be reversed.	

9 Component taping and additional tape requirements

9.1 All types

Components shall be prevented from falling out of the component window of the tape. This is normally done by cover tapes on one (blister-tape) or both (punched-tape) sides of the carrier tape. Requirements for types 1a, 1b, 2a, 2b and 3, which use cover tapes, are listed in Clause 8. Type 4 does not require a cover tape, because components are affixed to the adhesive backing when taped and are held in position.

Tapes in adjacent layers shall not stick together, when wound on the reel.

The tapes shall be suitable to withstand storage of the taped components without danger of migration of the terminations or the giving off of vapours which would make soldering difficult or deteriorate the component properties or terminations by chemical action.

The carrier tape material shall not age and lose strength so that it breaks on unreeling when the taped components are fed from the package by hand into the assembly machines. Carrier materials shall not delaminate in a manner that would prevent proper delivery of the component in the assembly process.

The break force of the tape in the direction of unreeling shall be at least 10 N. Properties of the splice tape should be such that it can be attached to the surface of the carrier tape and cover tape and will not hamper the transport of the carrier tape and cover tape. When splicing is applied, the misalignment of the holes on each side of the splice shall not be greater than ±0,15 mm in any direction.

To minimize the effect of losing components by electrostatic discharge, it is recommended that the packaging materials, component placement equipment, and controlled environmental conditions be optimized to effectively dissipate any charge build-up. This charge, commonly referred to as tribo-electric charge, should be controlled.

NOTE See IEC 61340-5-1 and IEC/TR 61340-5-2 for the guidelines.

9.2 Specific requirements for type 1b

The presence of burr, fluff or deformation should be kept to a minimum and shall not affect the removal of components. The presence of fluff shall not affect the mounting of the component.

Recommended measuring methods for carrier tape thickness (T and T_3), cavity (A_0 and B_0) and cavity depth (dimension K_0) shall be in accordance with Annex A.

9.3 Specific tape requirements for type 2b

The carrier tape and cover tape shall be made of a plastic material which does not shed particulates and has antistatic characteristics.

The carrier tape material should be suitable for use in the applicable cleanroom classification for which it is intended.

9.4 Specific requirement for type 4

9.4.1 General

Components shall be prevented from falling off the adhesive backing of the carrier tape and shall remain in fixed position for automatic handling. Components shall be firmly affixed to the adhesive backing. No lateral or rotational movement of the component is allowed after placement on the adhesive backing.

During unreeling, components shall be capable of clean release from the carrier tape, without damage or adhesive residue.

The adhesive backing shall remain in position and not become detached.

9.4.2 Coordinate system

For the coordinate system of tape type 4, the following requirements apply.

a) The coordinate system shown in Figure 24 is established to define carrier tape dimensioning together with component placements on adhesive-backed punched plastic carrier tapes.

b) The abscissa is a 0-0 datum straight line of infinite length to align the centres of a plurality of round sprocket holes throughout the entire length of the continuous tapes.

c) Ordinates are lines at right angles to the abscissa and uniformly spaced along its length to position the centre of each round sprocket hole aligned along the abscissa.

d) Compartments within the punched plastic carrier tape comprise virtual boundaries for the placement of components at predetermined pitch intervals throughout the length of the carrier tape.

e) Horizontal and vertical coordinates dimensioned from the abscissa and ordinates establish target location centre points for the planar centroids of the components placed within each virtual boundary.

f) The centre of the components shall be located within a 0,2 mm diameter of the target centerpoints within the virtual boundaries. See Figures 24 and 25.

g) Component rotation shall be limited to 5° from the abscissa axis centre line of the round sprocket holes (see Figure 19).

h) Adherence to the tolerances defined in Table 18 and Table 19 ensures that the following critical criteria are maintained:

    1) precise alignment of all round sprocket hole centres along abscissa;
    2) consistent pitch of the round sprocket holes throughout the entire length of the tape;
    3) uniform diameters of all round sprocket holes;
    4) polarity and orientation of components in the tape.

Table 23 – Absolute referencing data for component target position

Dimensions in millimetres

Tape size	F_A	P_{2A}
8	3,5	2,0
12	5,5	2,0
16	7,5	2,0
24	11,5	2,0

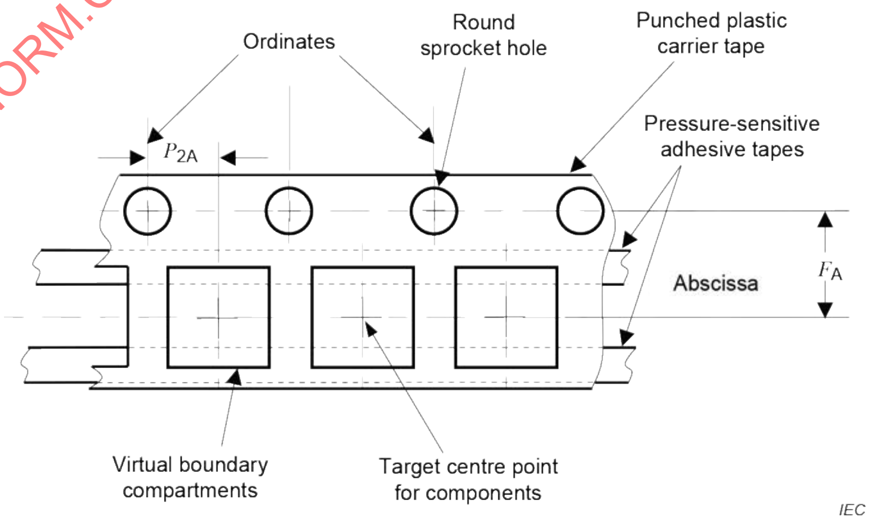


Figure 24 – Type 4 coordinate system

9.4.3 Component positioning and lateral displacement

For the component positioning and lateral displacement, see Figures 19 and 25. The component position in type 4 tape is not measured with respect to the compartment, as in types 1a, 1b, 2a, 2b and 3, but relative to a virtual target point at an absolute position given by P_{2A} and F_A. Table 23 gives the absolute position of this target point relative to the sprocket-hole centroid for different tape sizes.

The maximum displacement of the actual component position from this target location is shown in sketch S of Figure 25 and may be negative or positive. This displacement is a function of the accuracy of the component placement system and not the tape.

It is normal for the user drawing to specify the maximum component rotational and lateral displacement of the component when delivered in type 4, which may have a tighter tolerance than that shown in sketches R and S of Figure 25, where the repeatability of the component position at the pick point is critical. The component should not protrude above the top surface of the carrier tape. This is shown in Sketch R of Figure 25 where the component thickness (Z) shall not be more than the punched tape thickness (T).

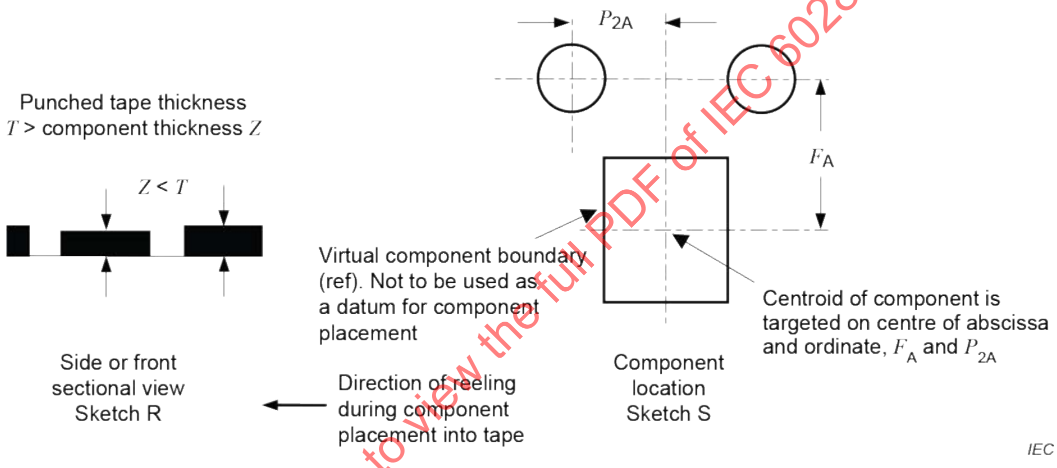


Figure 25 – Component clearance and positioning method

9.5 Specific requirements for tapes containing die products

9.5.1 General

Die products such as bare die and bumped die (flip-chip) require special handling to ensure the dies are not damaged during tape loading, transportation, storage and unloading. Tapes designed for these types of product normally contain certain design features to protect the die and prevent edge or corner chipping from occurring and, in the case of bumped die, to protect the bumps from damage. Particular care should be taken to prevent very thin die from sliding under the cover tape between adjacent pockets.

NOTE Refer to IEC/TR 62258-3 for handling recommendations.

The following items should be considered where the tape is used for die products.

9.5.2 Tape design for tapes containing die products

Types 1a, 2a, and 2b should have special design features to ensure the corners of the die do not contact the corners of the pocket. A square or circular relief may be used.

Types 2a and 2b should include special features in the base of the cavity to protect bumped die, where the die are placed in the pocket ‘bumps down’.

Type 4 does not require special features since it is inherently designed for die products.

NOTE Types 1b and type 3 are not suitable for use with die products.

9.5.3 Cleanliness

Tapes that are to be used for storing die products shall be in compliance with clean room class requirements. The sealed bags containing the tape shall only be opened in a suitable environment such as a clean room.

Tapes shall be free from any burrs or particles that may dislodge during handling or storage; they may stick to the surface of the die and cause damage.

Precautions should also be taken to ensure that no fibres or residue are released that could adhere to, or damage, the die product when the cover tape is removed.

9.5.4 Die lateral movement (types 1a, 2a and 2b)

The edges of die products are fragile and the design of the pocket in the tape should provide for minimal lateral movement of the die within the pocket during loading, unloading and transportation. Special punching or forming may be required to achieve the necessary tolerances to minimize lateral movement.

Die products generally require tighter tape tolerances to minimize lateral movement.

Tapes with a width W of 8 mm and 4 mm should allow for a lateral movement of 0,1 mm maximum. Tapes with a width W of more than 8 mm should allow for a lateral movement of 0,15 mm maximum.

10 Reel requirements

10.1 Dimensions

10.1.1 General

For the reeling of tapes, reels with the essential dimensions listed hereinafter shall be used. The total number of components on the reel shall be such that the components and the final cover do not extend beyond the smallest dimension of the flange (in the radial direction).

10.1.2 Reel dimensions

For the reel dimensions, see Figure 26 and Table 24.

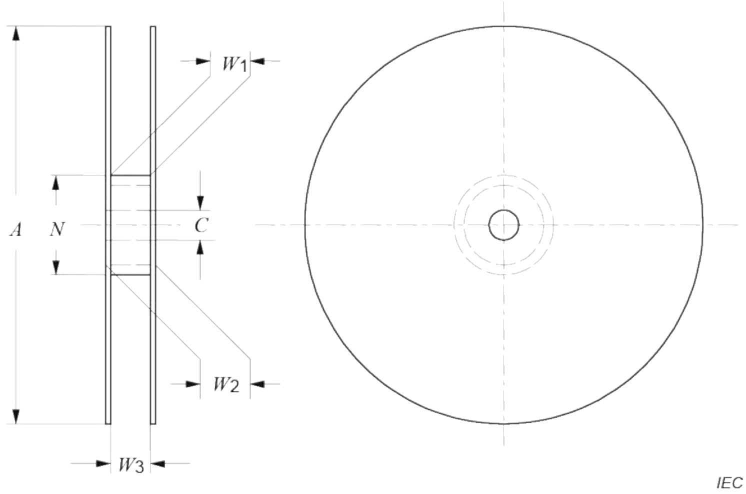


Figure 26 – Reel

Table 24 – Reel dimensions

Dimensions in millimetres

Tape width W	Reel diameter[a] A max.	Hub diameter N min.	Reel inner width W_1 [b]	Reel overall width W_2 max.	Reel inner width W_3 min.	Reel inner width W_3 max.
4	180	50	4,2 + 0,75	7,95	3,9	5,95
8	382	50	8,4 + 1,5	14,4	7,9	10,9
12		60 [d]	12,4 + 2	18,4	11,9	15,4
16		60	16,4 + 2	22,4	15,9	19,4
24		60 [c]	24,4 + 2	30,4	23,9	27,4
32		80	32,4 + 2	38,4	31,9	35,4
44		80	44,4 + 2	50,4	43,9	47,4
56		100	56,4 + 2	62,4	55,9	59,4
72	609	150	72,4 min.	89,0	Shall accommodate tape width without interference	
88			88,4 min.	105,0		
104			104,4 min.	121,0		
120			120,4 min.	137,0		
136			136,4 min.	153,0		
152			152,4 min.	169,0		
168			168,4 min.	185,0		
184			184,4 min.	201,0		
200			200,4 min.	217,0		

For the respective dimensional codes, see Figures 26.

[a] Preferred nominal reel diameters, in millimetres, are 180, 254, 284, 330, 360, 382 and 560. Market trend is towards a larger diameter.

[b] Measured at the hub.

[c] For type 4: 100 min.

[d] For punched tapes, the minimum diameter shall be 50 mm.

10.1.3 Reel hole dimensions

For the reel hole dimensions, see Figure 27 and Table 25.

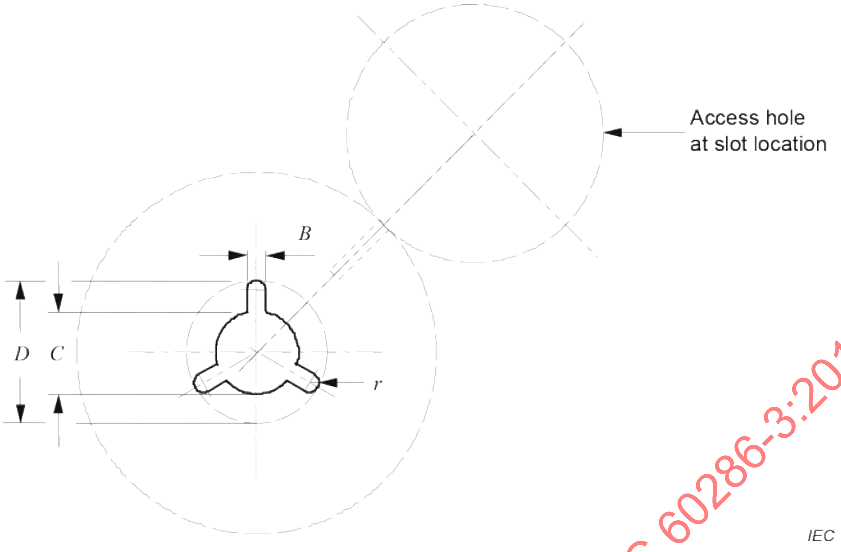


Figure 27 – Reel hole presentation

Table 25 – Reel hole dimensions

Dimensions in millimetres

Symbols	All types
B	1,5 minimum
D	20,2 minimum
C	12,8 minimum
r	0,5 × *B*
For respective dimensional codes, see Figures 27.	

An adequate tape slot at the hub of the reel may be provided for the trailer. There should then also be a corresponding adequate access hole.

10.2 Marking

The reel shall provide space for a label. The label shall be placed on the outside of the flange opposite the round sprocket holes (see Figure 28).

The marking on the reel shall comply with the requirements of the detail specification of the component.

Further information may be given by normal script or in code form for automatic reading, for example, OCR, bar code, magnetic, etc.

In the case of bar codes, it is recommended that bar code 39 be used, as specified in ISO/IEC 16388. For optical character recognition (OCR), OCR B should be used.

11 Tape reeling requirements

11.1 All types

Tape with components ready for assembly placement shall be spooled in such a way that the round sprocket holes shall be on the left-hand side as the tape enters the feeder as viewed from the back of the feeder looking towards the bed of the assembly machine.

Tape with components shall wrap around the hub (see dimension N in Figure 26) without damage.

Component tapes shall be wound on reels suitable for feeding automatic mounting machines.

The mounting side of the components shall be oriented to the bottom side of the tape. The bottom side is defined as the invisible side of the tape when reeled (see Figure 28).

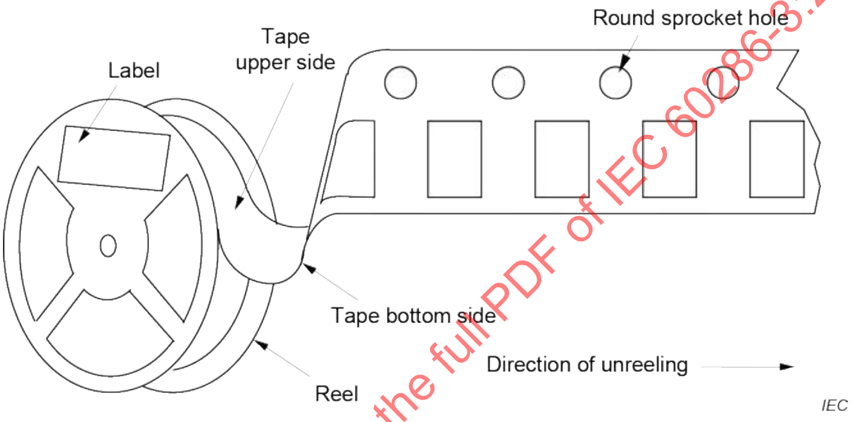


Figure 28 – Tape reeling and label area on the reel

11.2 Specific requirements for type 1a

Type 1a has effectively a cover tape on either side. If the mounting side needs to be reversed (as is the case for some surface-mounted components), then the tape shall be re-spooled and the alternate cover tape removed, to effectively invert the component.

11.3 Specific requirements for type 4

Generally, it is sufficient to wrap a layer of tape around the reel which normally comprises the leader for the tape, to protect the components in the tape. However, for additional protection or where the leader is insufficient, a static dissipative wrap may be wound around the completed reel.

11.4 Leader and trailer tape

11.4.1 General

For the leader and trailer, see 11.4.2, 11.4.3 and Figure 29.

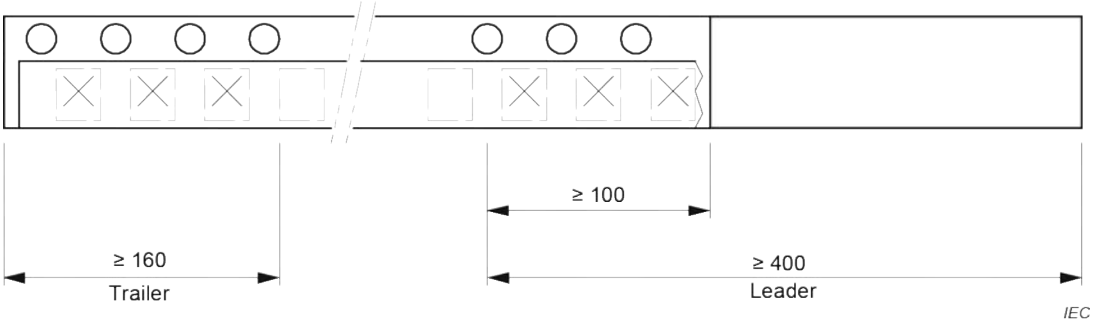


Figure 29 – Leader and trailer

11.4.2 Leader

For types 1a, 1b, 2a, 2b and 3 tapes, there shall be a leader of 400 mm minimum of cover tape, which includes at least 100 mm of carrier tape with empty compartments. All of the leader may consist of the carrier tape with empty compartments sealed by cover tape.

Type 4 tapes, which have no cover tape, shall include at least a leader of 100 mm of carrier tape with empty compartments.

11.4.3 Trailer

There shall be a trailer with a minimum of 160 mm carrier tape with empty compartments and sealed by the cover tape. The carrier tape shall be released from the reel hub as the last portion of the carrier tape unwinds from the reel.

11.5 Recycling

Tape and reels should be made of recyclable material. When such material is used in reels, a recycling symbol shall be marked on the reel.

ISO 11469 shall preferably be used for marking the material.

11.6 Missing components

The maximum number of missing components shall be 1 per reel or 0,025 %, whichever is greater.

There shall not be consecutive components missing from any reel for any reason.

Annex A
(normative)

Recommended measuring methods for type 1b

A.1 Measurement method for carrier tape thickness (T and T_3)

The equipment used to conduct these measurements shall be an external micrometer with a measuring pressure of 1,5 N or smaller. To measure the tape thickness at the cavity, including the puff, the probe shall be made of super-hard material with a recommended probe head diameter of 2,0 mm.

The thickness of the carrier tape shall be measured with an accuracy of 0,001 mm. The dimension of the thickness excluding the puff of the bottom of the cavity is T, when the flat side is measured adjacent to the round sprocket holes. The dimension of the thickness including the puff on the bottom of the cavity is T_3.

Measurement shall be made at the points shown in Figure A.1.

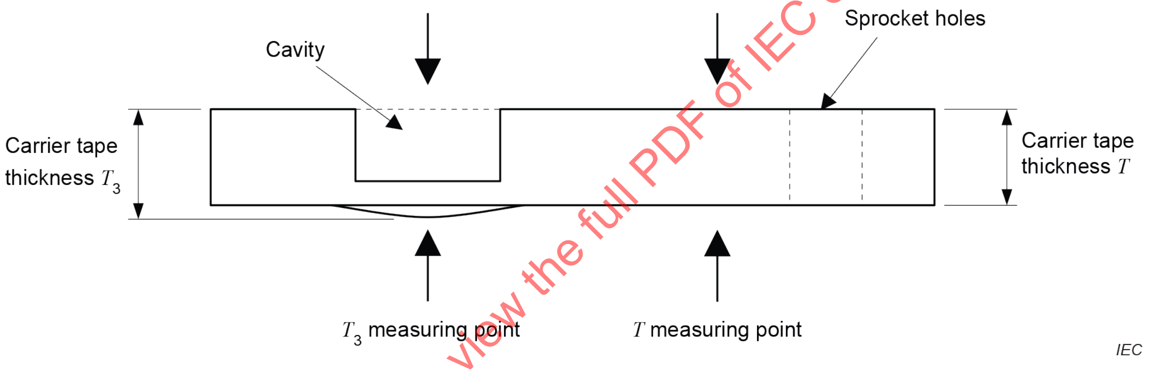


Figure A.1 – Carrier tape thickness measurement points

A.2 Measurement method for cavity (A_0 and B_0)

A measuring viewing scope with 10× magnification or more shall be used.

For dimensions A_0 and B_0, the minimum value including deformation of material shall be measured using an adequate light source to illuminate the surface of the tape and allow measurement of the features as shown in Figure A.2. Fluff should be excluded from the dimension.

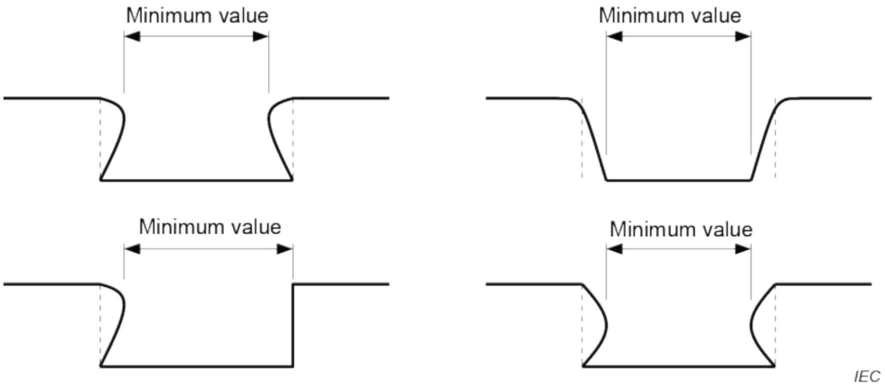


Figure A.2 – Cavity cross-section

A.3 Measurement method for cavity depth (dimension K_0)

The cavity depth K_0 should be the distance between the centre of the bottom of the cavity and the carrier surface at the centre point between the round sprocket hole and the cavity.

An example of a measurement of cavity depth K_0 is to use a non-contact measuring system to perform a measurement in accordance with Figure A.3.

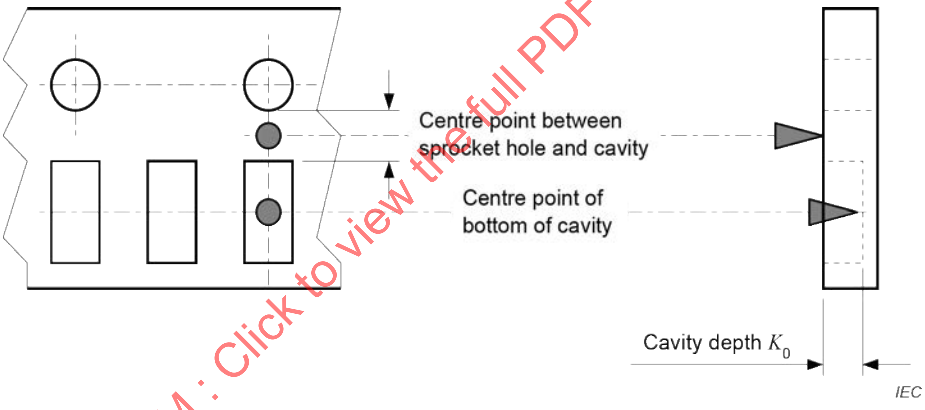


Figure A.3 – Cavity depth dimension

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

IEC TR 62258-3, *Semiconductor die products – Part 3: Recommendations for good practice in handling, packing and storage*

ISO/IEC 16388, *Information technology – Automatic identification and data capture techniques – Code 39 bar code symbology specification*

ISO 11469, *Plastics – Generic identification and marking of plastics products*

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

EMBALLAGE DE COMPOSANTS POUR OPÉRATIONS AUTOMATISÉES –

Partie 3: Emballage des composants pour montage en surface en bandes continues

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Cette sixième édition annule et remplace la cinquième édition parue en 2013. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) ajout d'un tableau de classification des symboles concernant les bandes, les bobines et les symboles courants;

b) ajout d'une figure représentant un exemple de polarité et d'orientation et d'une figure représentant un exemple de collage ponctuel;

c) révision des exigences de cambrage;

d) ajout d'une définition de la valeur de conception concernant l'inclinaison.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
40/2643/FDIS	40/2649/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 60286, publiées sous le titre général *Emballage de composants pour opérations automatisées*, peut être consultée sur le site web de l'IEC.

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INTRODUCTION

La mise en bande correspond aux exigences des machines de placement automatique pour les composants, et couvre aussi l'utilisation de la mise en bande des composants et des puces isolées pour des essais et autres opérations.

EMBALLAGE DE COMPOSANTS POUR OPÉRATIONS AUTOMATISÉES –

Partie 3: Emballage des composants pour montage en surface en bandes continues

1 Domaine d'application

La présente partie de l'IEC 60286 est applicable à la mise en bande des composants électroniques sans fils de sortie ou avec tronçons de sortie destinés à être connectés à des circuits électroniques. Elle fournit uniquement les dimensions essentielles pour la mise en bande des composants destinés aux opérations susmentionnées.

Le présent document inclut également des exigences relatives à l'emballage de produits à puce isolée incluant puces nues et puces à contact (puces retournées).

2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60191-2, *Normalisation mécanique des dispositifs à semiconducteurs – Partie 2: Dimensions*

3 Termes, définitions et symboles

3.1 Termes et définitions

Pour les besoins du présent document, les termes et définitions suivants s'appliquent. Les définitions s'appliquent à tous les types, sauf mention spécifique.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1.1
composants
partie électronique d'un produit qui ne peut pas être physiquement divisé en parties plus petites sans perdre sa fonction particulière

Note 1 à l'article: Cela inclut les produits à puce unique.

Note 2 à l'article: Cela est appliqué à tous les types d'emballages pour les puces nues isolées, sauf indication contraire.

3.1.2
taille du composant
taille du composant identifiée par son code de taille métrique

Note 1 à l'article: Ce code de taille est suivi par un M majuscule.

Note 2 à l'article: Pour éviter toute confusion possible avec les codes de taille en pouces, les équivalences sont données dans le Tableau 1.

Tableau 1 – Codes de taille des composants

Code de taille métrique	Code de taille en pouces
0402M	01005
0603M	0201
1005M	0402
1608M	0603
2012M	0805

3.1.3
emballage

produit composé de n'importe quel matériau de n'importe quelle nature destiné à être utilisé pour le confinement, la protection, l'alignement structuré pour un montage automatisé, la manutention et la livraison

3.1.4
bande d'entraînement formée à la presse

<Type 1b> bande d'entraînement présentant des cavités concaves formées par compression du matériau de base

3.1.5
peluche

<Type 1b> fibre du matériau de base attachée à l'intérieur de la cavité

Note 1 à l'article: Voir Figure 1.

3.1.6
bavure

<type 1b> saillie en surface d'une bande produite accidentellement pendant la formation d'une cavité

Note 1 à l'article: Voir Figure 1.

3.1.7
déformation

<type 1b> renflement sur la paroi interne de la cavité

Note 1 à l'article: Voir Figure 1.

3.1.8
boursouflure

<type 1b> renflement sur le côté externe de la cavité

Note 1 à l'article: Voir Figure 1.

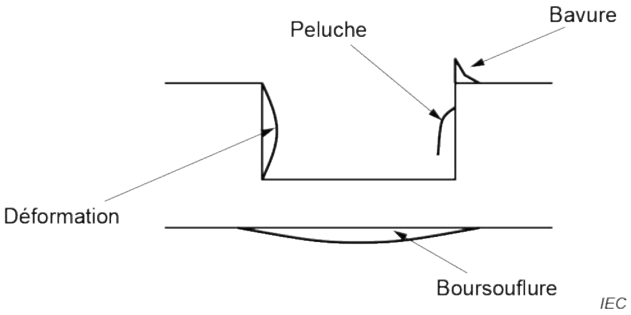


Figure 1 – Vue en coupe de la cavité du composant (type 1b)

3.1.9

bande d'entraînement gaufrée

bande d'entraînement identifiée comme faisant partie des types 2a, 2b et 3

Note 1 à l'article: Ces types de bandes sont également appelés des bandes d'entraînement "estampées".

3.2 Symboles

Les symboles utilisés dans le présent document sont répertoriés dans le Tableau 2.

Tableau 2 – Classification des symboles concernant les bandes, les bobines et les symboles courants

Symboles	Définitions	Références des figures
A	Diamètre de la bobine	Figure 26
A_0	Dimension du fond de la cavité dans le sens de déroulement	Figures 2, 4, 5, 7, 8, 10, 11, 13, 14, 16 et 20
B	Largeur de la rainure pour la clavette d'entraînement	Figure 27
B_0	Dimension du fond de la cavité dans le sens de la largeur de bande	Figures 2, 4, 5, 7, 8, 10, 11, 13, 14, 16 et 20
B_1	Rebord de la cavité dans le sens de la largeur de bande	Figures 8, 11 et 14
C	Diamètre de l'orifice de la bobine	Figures 26 et 27
C_T	Distance de la boursouflure sous la cavité dans le sens de la largeur de bande	Figure 5
d	Différence de diamètre entre la perforation d'entraînement et le trou rond	Figure 14
D	Diamètre de la fente d'entraînement de la bobine	Figure 27
D_0	Diamètre de la perforation d'entraînement	Figures 2, 5, 8, 11, 14 et 17
D_1	Diamètre du trou au fond de la cavité	Figures 8 et 14
E_1	Distance minimale, dans le sens de la largeur, entre le point d'origine d'une perforation ronde d'entraînement et le bord d'une face de la bande	Figures 2, 5, 8, 11, 14 et 17
E_2	Distance maximale, dans le sens de la largeur, entre le point d'origine d'une perforation ronde d'entraînement et le bord d'une face de la bande	Figures 2, 5, 8 et 11
F	Distance, dans le sens de la largeur, entre le point d'origine d'une perforation ronde d'entraînement et le centre de la cavité	Figures 2, 5, 8, 11 et 14
F_A	Distance, dans le sens de la largeur, entre le point d'origine d'une perforation ronde d'entraînement et le centre du compartiment	Figures 17, 19, 24 et 25
G	Distance minimale, dans le sens de la largeur, entre la cavité et le bord d'une face de la bande	Figures 2, 5, 8, 11 et 17

Symboles	Définitions	Références des figures
K_0	Profondeur de la cavité	Figures 2, 5, 8, 11, 14 et A.3
N	Diamètre du mandrin	Figure 26
P_0	Pas des perforations d'entraînement	Figures 2, 3, 5, 6, 8, 9, 11, 14 et 17
P_1	Pas de la cavité	Figures 2, 3, 5, 6, 8, 9, 11, 14, 17 et 18
P_2	Pas entre le centre d'une cavité aligné sur le point d'origine d'une perforation ronde d'entraînement et le centre de la cavité suivante, dans le sens de déroulement	Figures 2, 3, 5, 6, 8, 9, 11 et 14
P_{2A}	Pas entre la ligne centrale du point d'origine d'une perforation ronde d'entraînement et la ligne centrale du compartiment, dans le sens de déroulement	Figures 17, 18, 19, 24 et 25
P_3	Pas entre le centre d'une cavité aligné sur le point d'origine d'une perforation ronde d'entraînement et le centre de la deuxième cavité, dans le sens de déroulement	Figures 3 et 6
P_4	Pas entre le centre d'une cavité aligné sur le point d'origine d'une perforation ronde d'entraînement et le centre de la troisième cavité, dans le sens de déroulement	Figures 3 et 6
S	Pas de la perforation d'entraînement dans le sens de la largeur	Figure 14
R	Rayon de cintrage de la bande d'entraînement	Figure 21
r	Rayon de courbure de la rainure pour la clavette d'entraînement	Figure 27
T	Epaisseur de la bande d'entraînement sans bande de couverture	Figures 2, 5, 8, 11, 14, 17, 25 et A.1
T_1	Epaisseur de la bande de couverture inférieure ou supérieure	Figures 2, 5, 8, 11, 14 et 17
T_2	Somme de la hauteur externe de la cavité et de l'épaisseur de la bande de couverture	Figures 8, 11 et 14
T_3	Epaisseur de la bande d'entraînement formée à la presse avec le renflement	Figures 5 et A.1
V_1	Dimension du compartiment dans le sens de déroulement	Figures 17 et 18
V_2	Dimension du compartiment dans le sens de la largeur	Figures 17 et 18
W	Largeur de la bande d'entraînement	Figures 2, 5, 8, 11, 14 et 17
W_P	Distance entre les bandes adhésives	Figure 17
W_1	Largeur intérieure de la bobine (mesurée au niveau du mandrin)	Figure 26
W_2	Largeur extérieure de la bobine	Figure 26
W_3	Largeur intérieure de la bobine au niveau du rebord	Figure 26
Z	Epaisseur du composant	Figure 25

4 Structure de la spécification

Les différents types de bandes sont les suivants:

Type 1 – Bande d'entraînement perforée et formée à la presse

  Type 1a: Bande d'entraînement perforée, avec bande de couverture inférieure et supérieure (largeurs de bande: 8 mm et 12 mm)

  Type 1b: Bande d'entraînement formée à la presse, avec bande de couverture supérieure (largeurs de bande: 8 mm)

Type 2 – Bande d'entraînement gaufrée, avec perforations rondes d'entraînement simples

  Type 2a: Bande d'entraînement gaufrée, avec perforations rondes d'entraînement simples, une bande de couverture supérieure et des pas de bande jusqu'à 2 mm (largeurs de bande: 8 mm, 12 mm, 16 mm et 24 mm)

  Type 2b: Bande d'entraînement gaufrée, avec perforations rondes d'entraînement simples, une bande de couverture supérieure et un pas de bande de 1 mm (largeurs de bande: 4 mm)

Type 3 – Bande d'entraînement gaufrée, avec perforations d'entraînement doubles (largeurs de bande: 32 mm à 200 mm)

Type 4 – Bande d'entraînement en plastique perforée et adhésive pour puce nue isolée et autres composants pour montage en surface (largeurs de bande: 8 mm, 12 mm, 16 mm et 24 mm)

5 Exigences dimensionnelles pour la mise en bande

5.1 Exigences sur le positionnement des cavités de composants

5.1.1 Exigences pour les types 1a, 1b, 2a, 2b et 3

Pour le positionnement défini d'un composant, la cavité doit être définie à un point d'origine. L'origine est le centre de la perforation ronde d'entraînement, défini par le pointeur en croix des dimensions E_1 et P_0. Le centre du compartiment doit être défini par P_2 et F, par rapport à la perforation ronde d'entraînement (voir Figures 2, 5, 8, 11 et 14). Lorsque la dimension P_1 est inférieure ou égale à 2 mm, le décalage de logement maximal autorisé, par rapport au centre de la perforation ronde d'entraînement, doit être appliqué (voir Figures 3, 6, 9 et 12).

5.1.2 Exigences pour les types 4

Pour le positionnement défini d'un composant, le placement et l'emplacement du composant doivent être définis par rapport à un point d'origine. L'origine est le centre de la perforation d'entraînement, défini par le pointeur en croix des dimensions E_1 et P_0. Le centre de l'emplacement du composant doit être défini par P_{2A} et F_A, par rapport à la perforation d'entraînement (voir Figure 17). Le type 4 ne possède pas de cavités utilisées pour positionner les composants. Ainsi, il convient d'effectuer l'ensemble des mesures de position conformément au principe défini ici et non aux compartiments ou "logements" qui constituent des frontières virtuelles uniquement destinées à la protection des composants. Le terme "décalage de logement" ne s'applique pas au type 4. Les points suivants s'appliquent aux bandes de type 4:

a) le mouvement latéral et la rotation du composant sont définis par la précision à laquelle le composant a été placé dans le compartiment, par rapport à la cible;

b) Le composant ne doit pas dépasser la surface supérieure de la bande d'entraînement (voir Figure 25, croquis R);

c) les composants ne doivent pas changer d'orientation à l'intérieur de la bande;

d) le composant doit pouvoir être retiré verticalement de la cavité ou du compartiment sans restriction mécanique.

5.2 Exigences sur les dimensions des cavités des composants (bandes de types 1a, 1b, 2a, 2b et 3)

La taille de la cavité du composant, y compris les tolérances applicables, dépend des dimensions du composant auquel s'applique l'emballage pour garantir que le composant est bien protégé et que les mouvements d'inclinaison, de rotation et latéraux du composant sont conformes aux exigences décrites pour chaque type de bande. Les points suivants s'appliquent aux bandes de types 1a, 1b, 2a, 2b et 3:

a) les dimensions $A_0 \leq B_0$, sauf indication contraire dans la spécification particulière du composant;

b) les dimensions minimales et maximales du composant doivent être prises dans la spécification particulière du composant;

c) le composant ne doit pas dépasser la surface supérieure de la bande d'entraînement, sauf pour le type 1a où le composant ne doit dépasser aucune surface de la bande d'entraînement;

d) les composants ne doivent pas changer d'orientation à l'intérieur de la bande;

e) le composant doit pouvoir être retiré verticalement de la cavité ou du compartiment sans restriction mécanique, après que la bande de couverture supérieure a été enlevée, lorsqu'une bande de couverture est utilisée.

5.3 Type 1a – Bande d'entraînement perforée, avec bande de couverture inférieure et supérieure (largeurs de bande: 8 mm et 12 mm)

Pour les codes dimensionnels correspondants, se reporter aux Figures 2 à 4 et aux Tableaux 3 à 5.

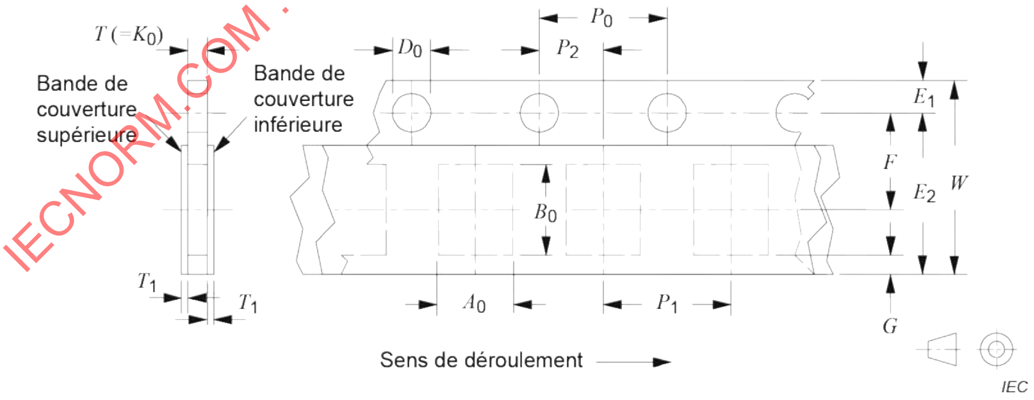


Figure 2 – Dimensions d'une bande d'entraînement perforée de 8 mm et 12 mm (pas de cavité 4 mm)

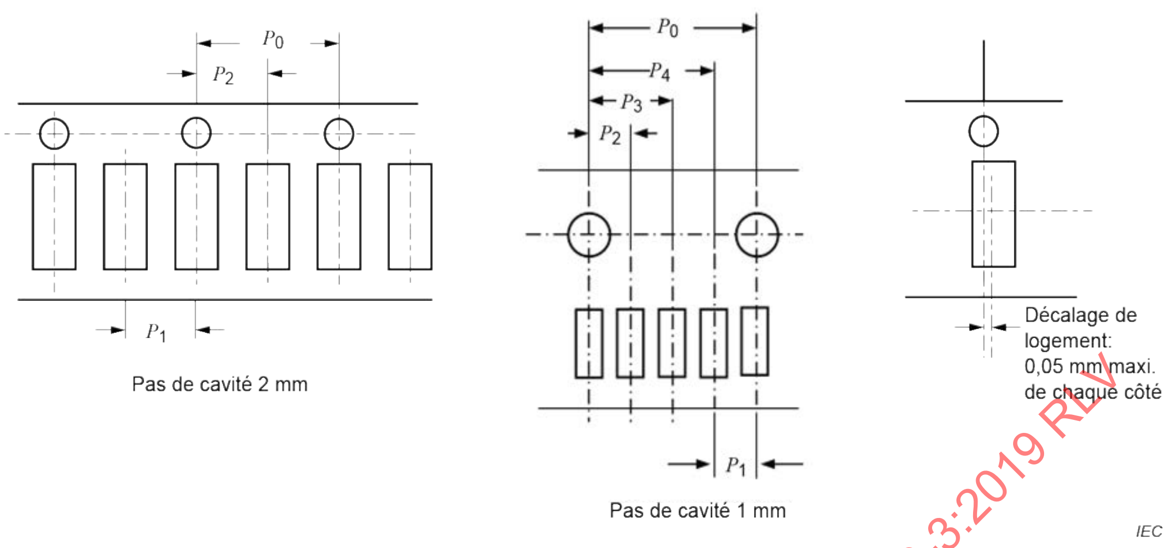


Figure 3 – Illustration du pas de cavité de 2 mm, du pas de cavité de 1 mm et du décalage de logement maximal

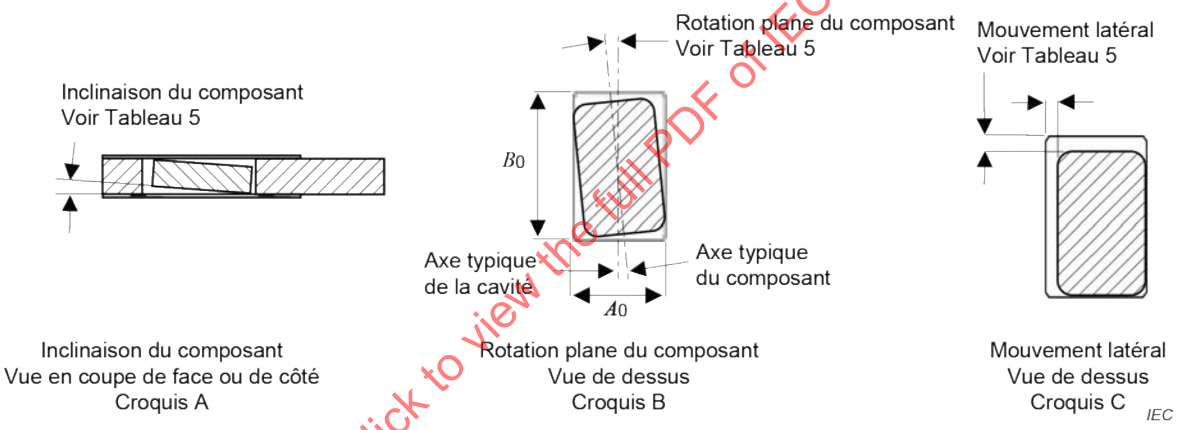


Figure 4 – Inclinaison, rotation et mouvement latéral maximaux du composant

Tableau 3 – Dimensions constantes d'une bande d'entraînement perforée de 8 mm et 12 mm

Dimensions en millimètres

Largeur de bande	D_0	E_1	P_0	G min.	T max.	T_1 (chaque T_1)	**Tolérance sur le pas cumulé P_0**
8 et 12	$1{,}5^{+0{,}1}_{0}$	1,75 ± 0,1	4,0 ± 0,1 ($P_1 \geq 4$) 4,0 ± 0,05 ($P_1 = 2$, $P_1 = 1$)	0,75	1,1 papier [a] 1,6 sans papier	0,1 maximum	Pas ± 0,2 / 10

Pour les codes dimensionnels correspondants, se reporter à la Figure 2.

[a] Le papier est le matériau utilisé pour la bande d'entraînement perforée.

Tableau 4 – Dimensions variables d'une bande d'entraînement perforée de 8 mm et 12 mm

Dimensions en millimètres

Largeur de bande	E_2 min.	F	P_1	P_2	P_3	P_4	W	A_0, B_0, K_0
8	6,25	3,5 ± 0,05	1,0 ± 0,05 (P_1 = 1) 2,0 ± 0,05 (P_1 = 2) 4,0 ± 0,1 (P_1 = 4)	1,0 ± 0,05 (P_1 = 1) 2,0 ± 0,05 (P_1 = 2) 2,0 ± 0,05 (P_1 = 4)	2,0 ± 0,05 (P_1 = 1)	3,0 ± 0,05 (P_1 = 1)	$8,0^{+0,3}_{-0,1}$	Voir 5.2
12	10,25	5,5 ± 0,05	2,0 ± 0,05 (P_1 = 2) 4,0 ± 0,1 (P_1 ≥ 4)	2,0 ± 0,05	–	–	$12,0^{+0,3}_{-0,1}$	

Pour les codes dimensionnels correspondants, se reporter aux Figures 2 à 4.

Tableau 5 – Inclinaison, rotation plane et mouvement latéral du composant

Largeur de bande mm	Inclinaison du composant (valeur de conception) [a]	Rotation plane du composant (valeur de conception) [a]	Mouvement latéral mm
8 et 12	10° maximum	20° maximum	0,3 maximum (P_1 = 1, P_1 = 2) 0,5 maximum (P_1 ≥ 4)

Pour les codes dimensionnels correspondants, se reporter à la Figure 4.

Pour les composants dont la longueur ou la largeur est inférieure à 1,2 mm, la tendance pour la rotation plane admise des composants est de 10° maximum.

Pour les composants dont la longueur ou la largeur est inférieure à 1,2 mm, la tendance du marché est un mouvement latéral de 0,2 mm maximum.

Lorsque des produits à puce nue sont manipulés dans des bandes de 8 mm, il convient d'autoriser un mouvement latéral maximal de 0,1 mm pour n'importe quelle dimension de cavité.

Lorsque des produits à puce nue sont manipulés dans des bandes de 12 mm, il convient d'autoriser un mouvement latéral maximal de 0,15 mm pour n'importe quelle dimension de cavité.

[a] La valeur de conception est une valeur calculée à des fins de conception uniquement. Par exemple, l'inclinaison du composant n'est pas destinée à être mesurée; il s'agit de la valeur calculée destinée à la conception du logement dans une bande d'entraînement.

5.4 Type 1b – Bande d'entraînement formée à la presse, avec bande de couverture supérieure (largeurs de bande: 8 mm)

Pour les codes dimensionnels correspondants, se reporter aux Figures 5 à 7 et aux Tableaux 6 à 8.

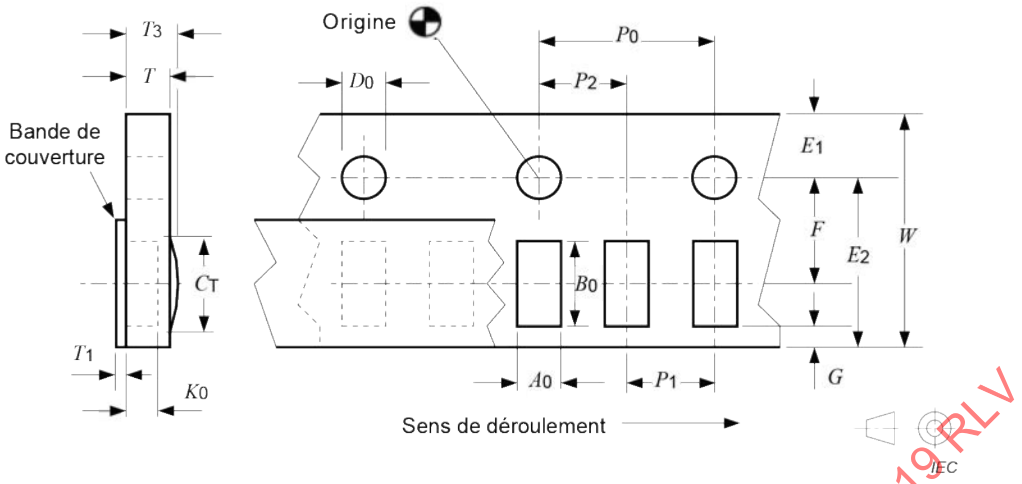


Figure 5 – Dimensions (P_0 = 4 mm/P_1 = 2 mm) et (P_0 = 4 mm/P_1 = 1 mm)

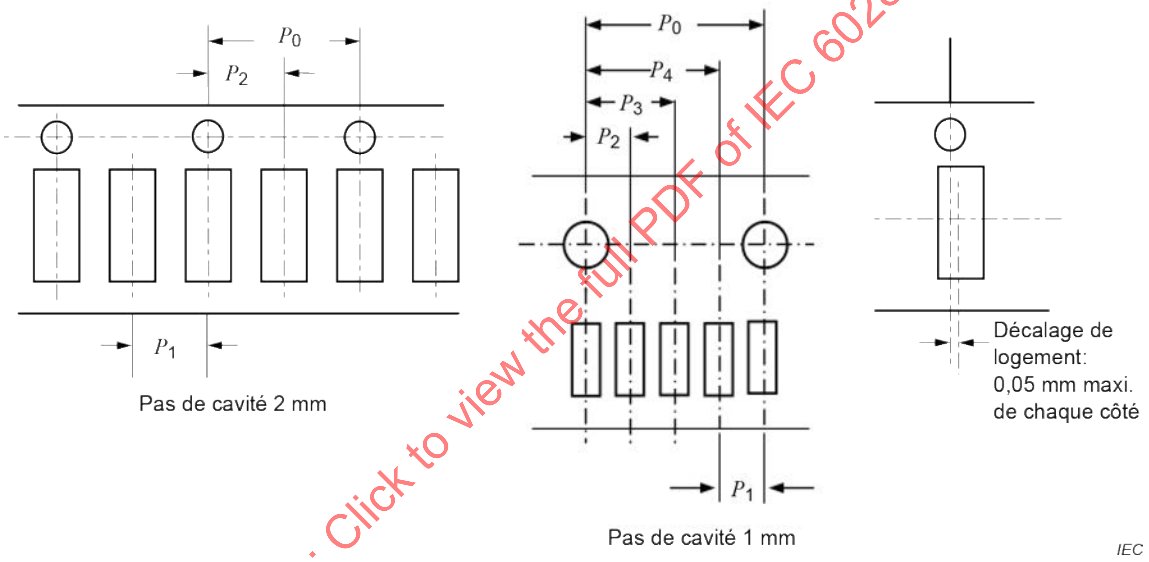
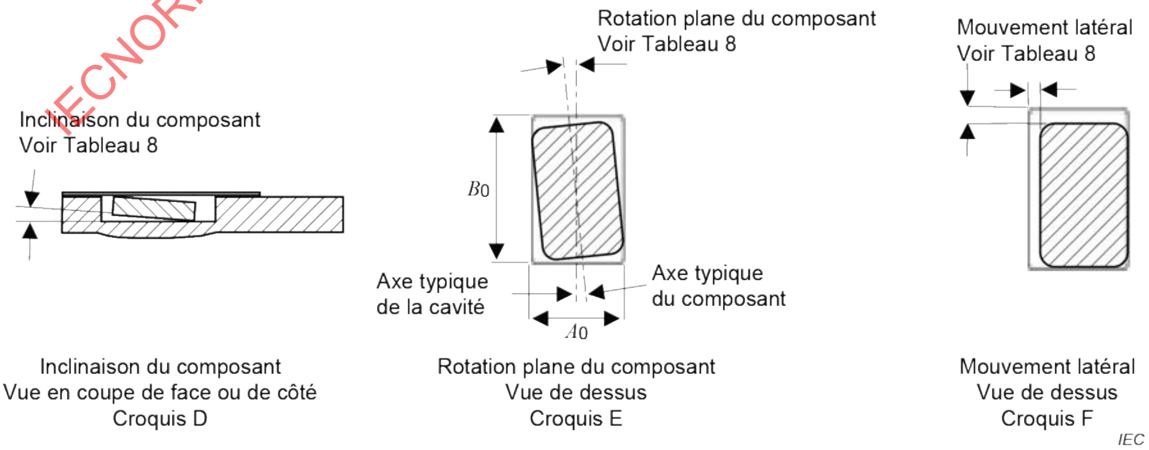


Figure 6 – Illustration du pas de cavité de 2 mm, du pas de cavité de 1 mm et du décalage de logement maximal



Inclinaison du composant
Vue en coupe de face ou de côté
Croquis D

Rotation plane du composant
Vue de dessus
Croquis E

Mouvement latéral
Vue de dessus
Croquis F

Figure 7 – Inclinaison, rotation et mouvement latéral maximaux du composant

Tableau 6 – Dimensions constantes d'une bande d'entraînement formée à la presse de 8 mm

Dimensions en millimètres

Largeur de bande	D_0 [a]	E_1	G min.	P_0	T max.	T_1 max.	T_3-T [b] max.	Tolérance sur le pas cumulé P_0
8	$1{,}5^{+0{,}1}_{0}$	1,75 ± 0,1	0,75	4,0 ± 0,1	1,1	0,1	0,1	Pas ± 0,1 / 10

Pour les codes dimensionnels correspondants, se reporter aux Figures 5 et 6.

[a] Si une précision de positionnement est exigée, par exemple lorsque des composants de taille ≤ 1005M sont montés dans un espace réduit, alors il convient que la tolérance sur D_0 soit +0,05 / -0,00 mm.

[b] Pour les composants de taille 1005M ou inférieure, il convient de limiter la boursouflure ($T_3 - T$) à 0,05 mm maximum.

Tableau 7 – Dimensions variables d'une bande d'entraînement formée à la presse de 8 mm

Dimensions en millimètres

Largeur de bande	C_T max.	E_2 min.	F	P_1	P_2	P_3	P_4	W	A_0, B_0, K_0
8	4,35	6,25	3,5 ± 0,05	1,0 ± 0,05 (P_1 = 1) 2,0 ± 0,05 (P_1 = 2) 4,0 ± 0,1 (P_1 = 4)	1,0 ± 0,05 (P_1 = 1) 2,0 ± 0,05 (P_1 = 2) 2,0 ± 0,05 (P_1 = 4)	2,0 ± 0,05 (P_1 = 1)	3,0 ± 0,05 (P_1 = 1)	$8{,}0^{+0{,}3}_{-0{,}1}$	Voir 5.2.

Pour les codes dimensionnels correspondants, se reporter aux Figures 5 à 7.

Tableau 8 – Inclinaison, rotation plane et mouvement latéral du composant

Largeur de bande mm	Inclinaison du composant (valeur de conception) [a]	Rotation plane du composant (valeur de conception) [a]	Mouvement latéral mm
8	20° maximum	20° maximum	0,12 maximum (taille du composant ≤ 0603M) 0,20 maximum (taille du composant 1005M) 0,30 maximum (taille du composant ≥ 1608M)

Pour les codes dimensionnels correspondants, se reporter à la Figure 7.

[a] La valeur de conception est une valeur calculée à des fins de conception uniquement. Par exemple, l'inclinaison du composant n'est pas destinée à être mesurée; il s'agit de la valeur calculée destinée à la conception du logement dans une bande d'entraînement.

5.5 Type 2a – Bande d'entraînement gaufrée, avec perforations rondes d'entraînement simples et des pas de bande jusqu'à 2 mm (largeurs de bande: 8 mm, 12 mm, 16 mm et 24 mm)

Pour les codes dimensionnels correspondants, se reporter aux Figures 8 à 10 et aux Tableaux 9 à 11.

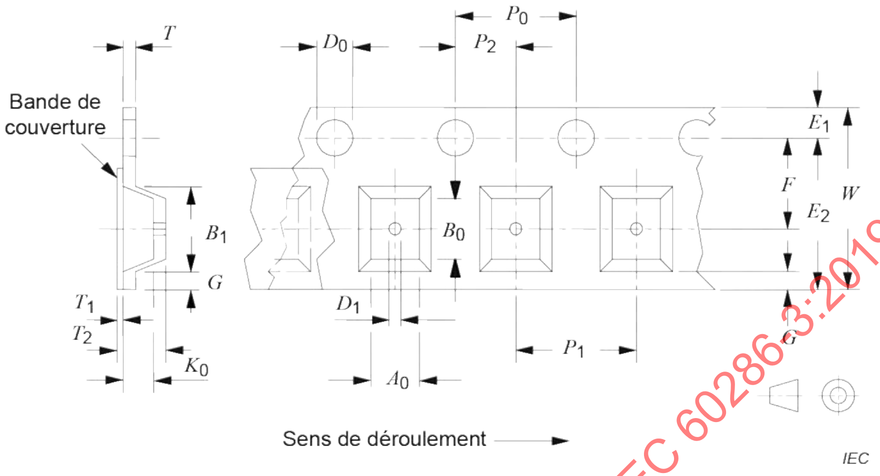


Figure 8 – Dimensions d'une bande d'entraînement gaufrée (8 mm, 12 mm, 16 mm et 24 mm)

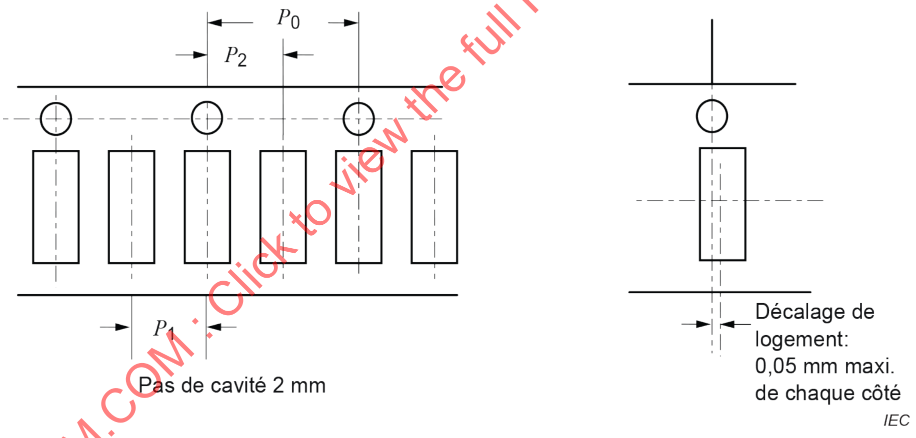
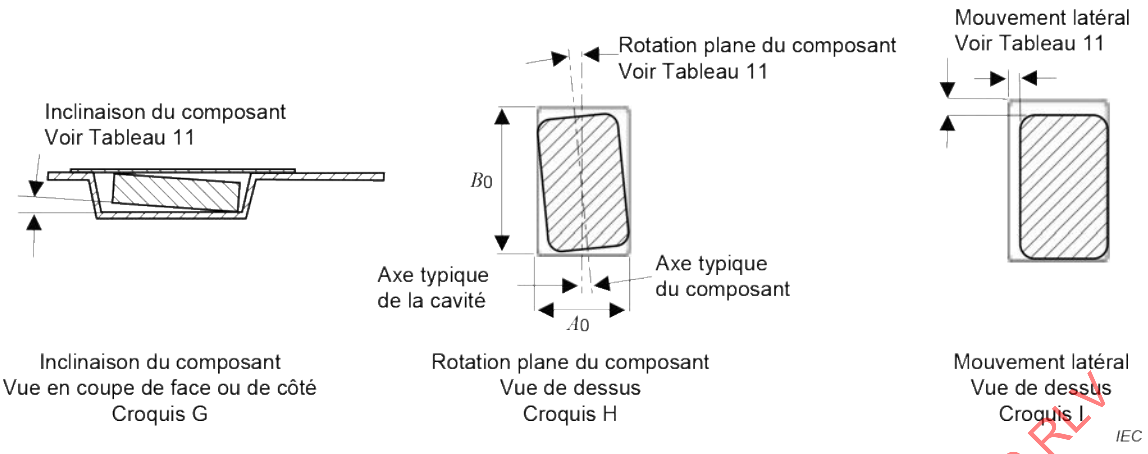


Figure 9 – Illustration du pas de cavité de 2 mm et du décalage de logement



Inclinaison du composant
Vue en coupe de face ou de côté
Croquis G

Rotation plane du composant
Vue de dessus
Croquis H

Mouvement latéral
Vue de dessus
Croquis I

Figure 10 – Inclinaison, rotation et mouvement latéral maximaux du composant

Tableau 9 – Dimensions constantes d'une bande d'entraînement gaufrée de 8 mm à 24 mm

Dimensions en millimètres

Largeur de bande	D_0	E_1	G min.	P_0	T max.	T_1 max.	Tolérance sur le pas cumulé P_0
8 à 24	$1{,}5^{+0,1}_{0}$	1,75 ± 0,1	0,75	4,0 ± 0,1 ($P_1 \geq 4$) 4,0 ± 0,05 ($P_1 = 2$)	0,6	0,1	Pas ± 0,2 / 10

Pour les codes dimensionnels correspondants, se reporter aux Figures 8 et 9.

Tableau 10 – Dimensions variables d'une bande d'entraînement gaufrée de 8 mm à 24 mm

Dimensions en millimètres

Largeur de bande	B_1 max.	D_1 [a] min.	E_2 min.	F	P_1	P_2	T_2 max.	W	A_0, B_0, K_0
8	4,35	0,3	6,25	3,5 ± 0,05	2,0 ± 0,05 4,0 ± 0,1	2,0 ± 0,05	3,5	$8{,}0^{+0,3}_{-0,1}$	Voir 5.2.
12	8,2	1,5	10,25	5,5 ± 0,05	2,0 ± 0,05 4,0 ± 0,1 à 12,0 ± 0,1 par incréments de 4,0	2,0 ± 0,05	6,5	$12{,}0^{+0,3}_{-0,1}$	
16	12,1	1,5	14,25	7,5 ± 0,1	4,0 ± 0,1 à 16,0 ± 0,1 par incréments de 4,0	2,0 ± 0,1	9,5	$16{,}0^{+0,3}_{-0,1}$	
24	20,1	1,5	22,25	11,5 ± 0,1	4,0 ± 0,1 à 24,0 ± 0,1 par incréments de 4,0	2,0 ± 0,1	12,5	$24{,}0^{+0,3}_{-0,1}$	

Pour les codes dimensionnels correspondants, se reporter aux Figures 8 à 10.

[a] (facultatif) Pour faciliter et optimiser le retrait du composant ou pour inspecter le composant pour n'importe quelle application applicable, le centre du fond de la cavité peut comporter un trou.