IEC 60286-2

Edition 5.0 2022-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

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

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

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PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

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

FOREWORD

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IEC 60286-2 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2015. This edition constitutes a technical revision.

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

a) complete revision of structure;
b) consolidation of essential parameters and requirements in Clause 4.

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

Draft	Report on voting
40/2974/FDIS	40/2996/RVD

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

The language used for the development of this International Standard is English.

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.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under 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- withdrawn,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.

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

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

1 Scope

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

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

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
packaging
product made of any material of any nature to be used in containment, protection, structured alignment for automatic assembly, handling, and delivery

3.2
unguided lead
lead which is not held between carrier tape and hold-down tape

Note 1 to entry: See Figure 5.

3.3
crimp
cinch
purposely formed angular deformation, starting at the reference plane, in such a way that the component bottom side does not touch the top surface of the printed circuit board after insertion and therefore acts as a "stand-off"

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

3.4
ordinate
straight line, perpendicular to the abscissa through the centre of the closest sprocket hole that follows the component to be checked

3.5
abscissa
straight line, through the centres of the sprocket holes in the direction of unreeling

3.6
seating plane
<components with straight leads> bottom of the component body, including any projections which support the component on the printed board

Note 1 to entry: See Figure 1

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

3.7
seating plane
<components with crimped (or preformed) leads> plane that changes depending on the profile of the crimp, the diameter of the leads and the hole size in the printed board

Note 1 to entry: See Figure 1 and Figure 2.

Note 2 to entry: For components with crimped (or preformed) leads, a reference plane is defined instead of a seating plane.

Note 3 to entry: A method for determining the seating plane is given in IEC 60717.

3.8
reference plane
line parallel to the abscissa through the lowest centre of the radius of curvature of the bending of the crimp

Note 1 to entry: See Figure 1 and Figure 2.

4 Dimensions and specific requirements

4.1 General

The symbols and dimensions are given in Figure 1 to Figure 6, Table 1, Annex A and Annex B. All dimensions of the component leads have the centreline of the lead as the reference line.

4.2 Coordinate system

The coordinate system common to tapes and taped components consists of an abscissa and an ordinate, both using the centre of the sprocket hole that follows the component to be checked as the reference point (see Figure 1).

To determine the position of components in the taped condition, the seating plane shall be used for components with straight leads, and the reference plane for components with crimped (or otherwise formed) leads (see Figure 2).

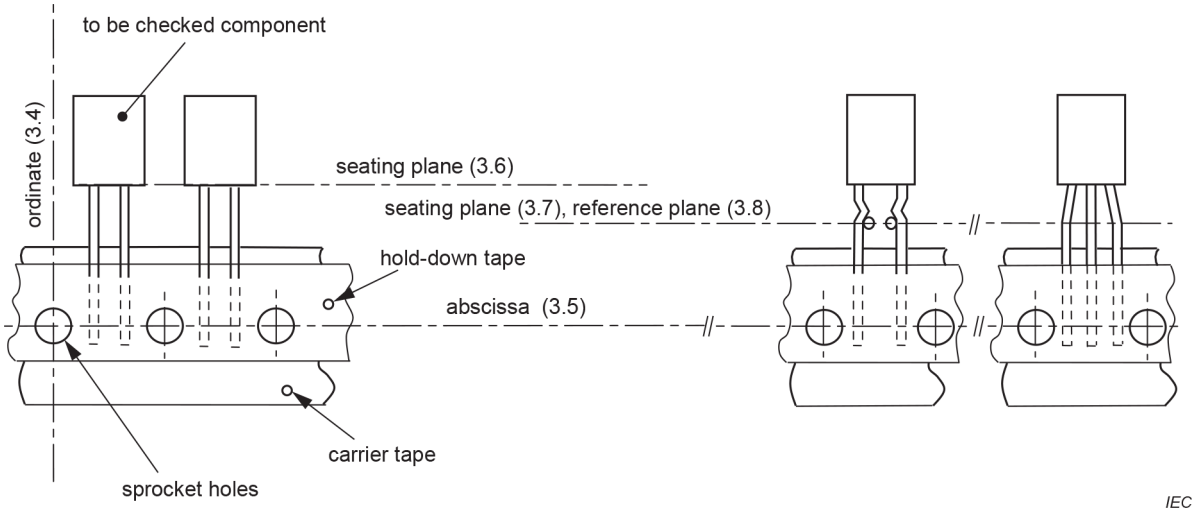


Figure 1 – Abscissa, ordinate, reference plane and seating plane

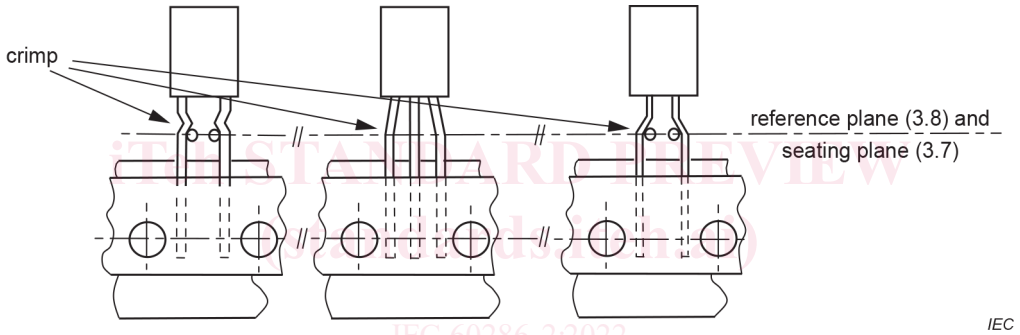
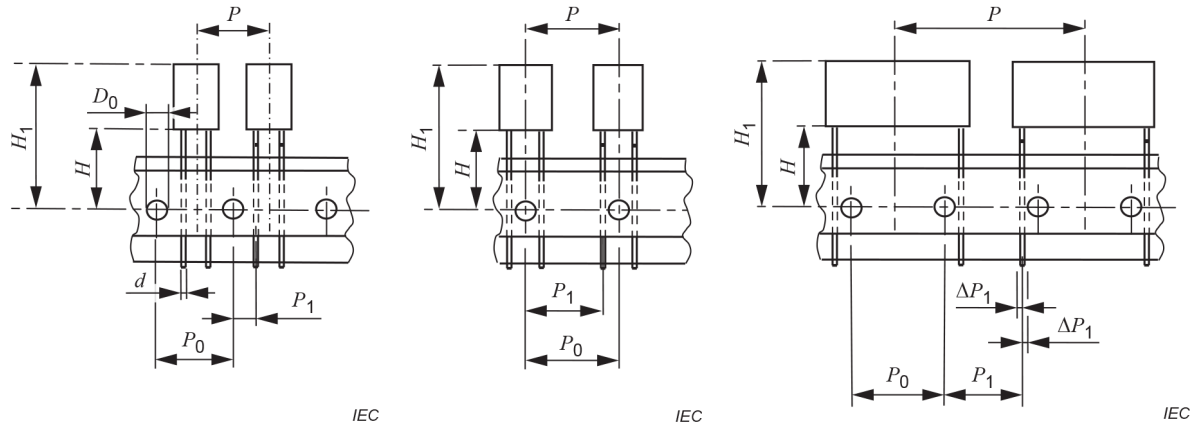


Figure 2 – Crimped or otherwise formed leads

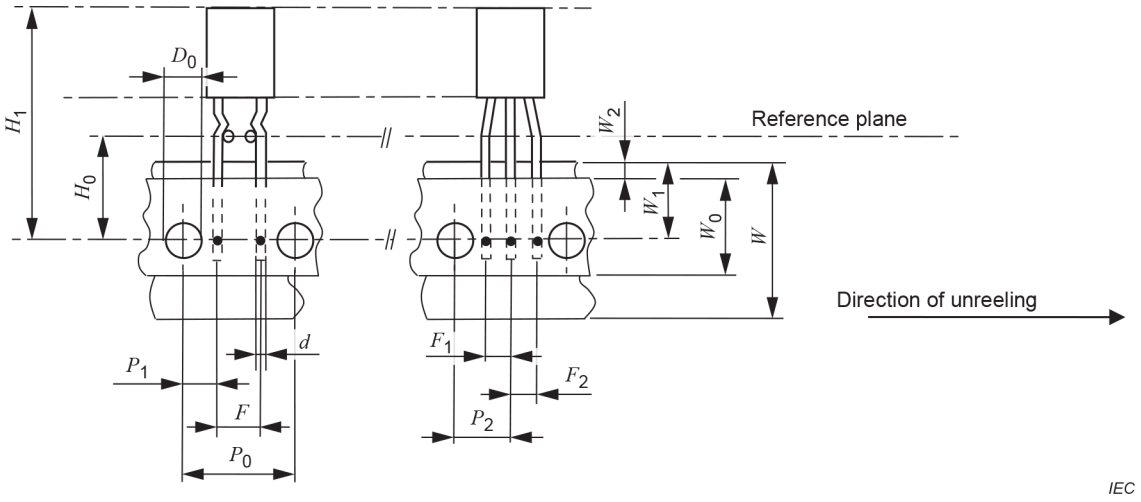
4.3 Lead taping dimensions

Figure 3 to Figure 5 (Sketch A to Sketch F) provide examples of different taping styles. Table 1 lists the related symbols.



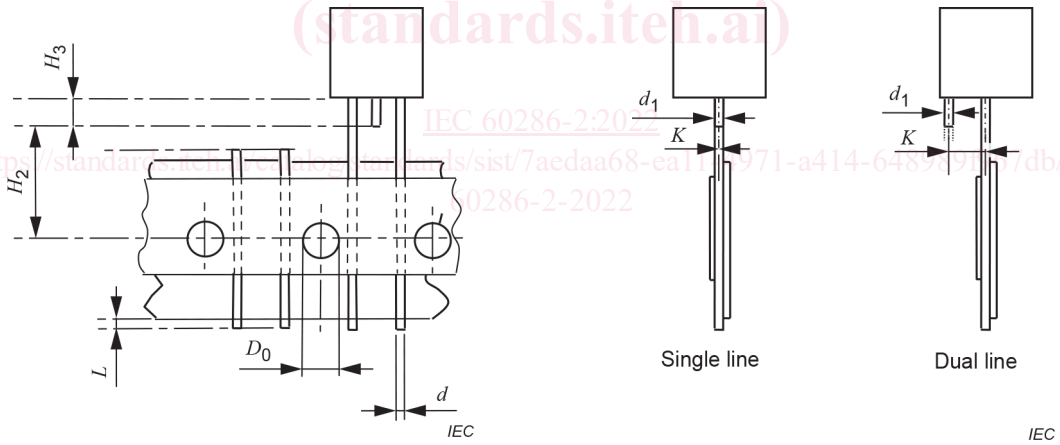
Sketch A **Sketch B** **Sketch C**

Figure 3 – Lead taping dimensions (straight leads)



Sketch D

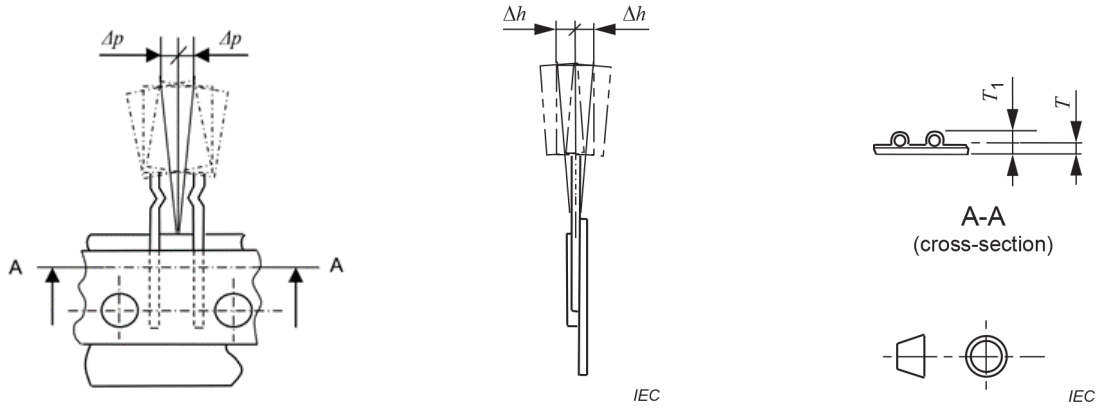
Figure 4 – Lead taping dimensions (crimped leads)



Sketch E **Sketch F**

Figure 5 – Lead taping dimensions – unguided leads

Front-to-back tilt and lateral tilt of components from the ideal position in tape are defined as Δh deviations and Δp deviations in Figure 6.



Sketch G **Sketch H** **Sketch I**

Figure 6 – Front-to-back and lateral deviations

Table 1 provides the symbols, definitions, values and tolerances of those dimensions, which are essential to specify the tape and taped components for automatic handling by inserters.

In Annex A and Annex B, examples for the dimensions of common component styles are given.

Table 1 – Lead taping dimensions

Symbol	Description	Sketch in Figure 3 to Figure 6	Dimension	Requirements
			(mm)	
d	Lead diameter	A, D, E	Annex A Annex B	[a] 4.5.2
d_1	Diameter of unguided lead	F		
D_0	Sprocket hole diameter	A, D, E	(4,0 ± 0,2)	
F	Lead spacing (tolerance)	D	Annex A (+0,5 / −0,2)	4.5.3
F_1	Lead spacing tolerance between left lead and centre lead of the components with three leads (tolerance)	D	Annex B (+0,4 / −0,1)	4.5.3
F_2	Lead spacing tolerance between right lead and centre lead of the components with three leads (tolerance)	D	Annex B (+0,4 / −0,1)	4.5.3
H	Distance between the abscissa and the bottom plane of the component body	A, B, C	$18\ ^{+2}_{0}$	
H_0	Distance between the abscissa and the reference plane of components with crimped leads (for crimped leads only)	D	(16,0 ± 0,5)	
H_1	Distance between the abscissa and the top of the body of the components	A, B, C, D	Annex A Annex B	[a]
H_2	Distance between the abscissa and tip of unguided lead	E	$17\ ^{+2}_{0}$ [a]	4.7.1
H_3	Distance between the bottom of components and tip of unguided lead	E	3 max. [a]	4.7.2
$\lvert\Delta h\rvert$	Maximum front-to-back deviation of the component body vertical to the tape plane	H	≤ 2	4.6

Symbol	Description	Sketch in Figure 3 to Figure 6	Dimension (mm)	Requirements
K	Distance between the lead and the unguided lead	F	Single line: ±0,3 Dual line: (2,5 ± 0,3)	4.7.3
L	Protrusion beyond the lower side of the carrier tape	E	≤ 0,5	
P	Pitch between two consecutive components	A, B, C	Annex A Annex B	[a]
P_0	Pitch of the sprocket holes	A, B, C, D	Annex A Annex B	[a]
P_1	Distance between ordinate and first lead of the drawer side	A, B, C, D	Annex A	[a]
P_2	Distance between the ordinate and the centre lead of the component on the drawer side	D	Annex B	[a]
$\|\Delta p\|$	Maximum lateral deviation of the component body in the tape plane	G	≤1,3	4.6
$\|\Delta P_1\|$	Maximum deviation of component lead position (dimension P_1) from the upper edge of the carrier tape to the seating plane level.	C	≤ 0,7	4.6
T	Thickness of the carrier tape and the hold-down tape	I	≤ 0,9	
T_1	Total thickness of the carrier tape, the hold-down tape and diameter of the lead	I	Annex A Annex B	[a]
W	Carrier tape width	D	$18^{+1}_{-0,5}$	
W_0	Hold-down tape width	D	5,0 min.	6.3
W_1	Distance between the upper edges of the carrier tape and the abscissa (centre of the sprocket hole)	D	$9^{+0,75}_{-0,5}$	
W_2	Distance between the upper edges of the carrier tape and the hold-down tape	D	3,0 max.	

[a] Recommended value, unless otherwise specified by agreement between manufacturer and customer.

4.4 Specific requirements to components and sprocket hole pitches (P, P_0, P_1, P_2, D_0)

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

The grid is defined as lead spacing e = 2,5 mm.

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

Components with a lead spacing of $F = 8 \times e$ to $11 \times e$ may be delivered with one or two sprocket holes arranged between the leads of the component (see Figure 3, Sketch B and Sketch C).

Dimension P, dimension P_0, dimension P_1 and dimension P_2, are given in Annex A and Annex B.

The cumulative sprocket hole pitch tolerance shall not exceed ±1 mm over 20 consecutive pitches.

Dimension D_0 is given in Table 1.

4.5 Specific requirements to leads

4.5.1 General

The leads of the taped components shall be free of kinks or bends from the seating plane or reference plane downward to the carrier tape.

The leads of components shall be taped and handled so that lead spacing can easily be maintained within tolerances after separation or removal from the tape.

The leads shall not interfere with the sprocket holes.

4.5.2 Lead diameter (d, d_1)

Diameter d and diameter d_1 of the lead terminal should be selected in accordance with IEC 60301.

Market trend for automatic insertion, where lead spacing is F = 5 mm, the recommended lead diameters are 0,6 mm maximum, and where lead spacing is F = 7,5 mm, the recommended lead diameters are 0,8 mm maximum.

Lead diameters outside this range are commonly available but compatibility with high-speed automatic insertion machines should be considered.

Leads with cross-sections other than circular may be used. A circle going through the corners of the non-circular cross-section is the equivalent circular cross-section.

4.5.3 Lead spacing (F, F_1, F_2)

Dimension F is given in multiples of 2,5 mm.

Dimensions F, dimension F_1 and dimension F_2 are measured at the egress from the carrier tape, on the component side.

Tolerances of dimension F, dimension F_1 and dimension F_2 are given in Table 1.

4.6 Specific requirements to component position in taping (Δh, Δp, ΔP_1)

lΔhl is the maximum lateral deviation of the component body vertical to the tape plane from the nominal position.

lΔpl is the maximum deviation of the component body in the tape plane.

$|\Delta P_1|$ is the maximum deviation of the component leads position from the upper edge of the tape to the seating plane or reference plane respectively, valid for all values of dimension P_1.

The maximum deviations of $|\Delta h|$, $|\Delta p|$ and, $|\Delta P_1|$ are given in Table 1.

4.7 Specific requirements to components with unguided leads

4.7.1 Distance between the abscissa and tip of unguided lead (H_2)

Unless otherwise specified by agreement between the manufacturer and the customer, dimension H_2 should be 17,0 $^{+2,0}_{0}$ mm.

4.7.2 Distance between the bottom of the component and the tip of the unguided lead (H_3)

Unless otherwise specified by agreement between the manufacturer and the customer, the dimension H_3 should be 3 mm maximum.

4.7.3 Distance between the lead terminal and the unguided lead (K)

Distance K affects the component mounting quality and is essential for specifying taped components and taping for automatic handling by inserters. See Figure 5 (Sketch F) and Figure 7.

Dimensions in millimetres

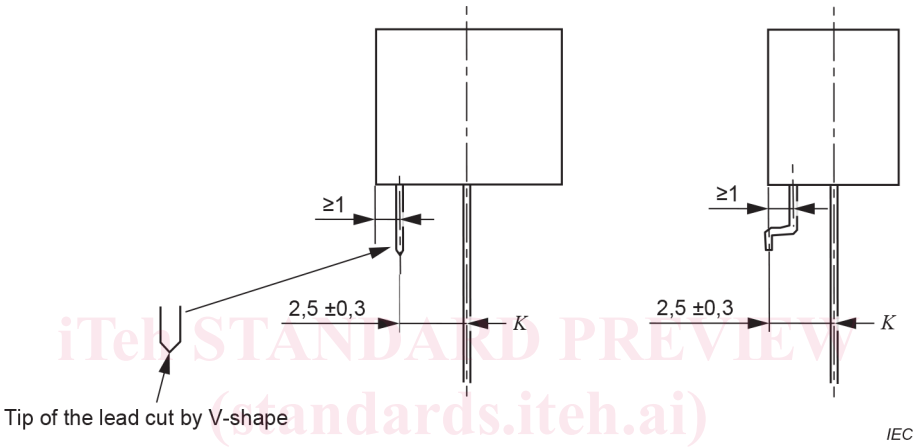


Figure 7 – Position of short terminal without tape

Unless otherwise specified by agreement between the manufacturer and the customer, the recommended nominal values and tolerances of distance K are:

– Tolerance of distance K for single line configuration ±0,3 mm

– Dimension and tolerance of distance K for dual line configuration $K = 2{,}5\ ^{+0,3}_{-0,3}$ mm

The tip of the unguided lead should be formed in a V-shape (see Figure 7).

NOTE Normally, the manufacturer provides the customers with information about the design of the terminal holes in the circuit board to enable a smooth automatic insertion of components with unguided leads. For example, a component manufacturer recommends that the clearance between the tip of the unguided lead and the terminal hole in the board be larger than the clearance between the taped lead and the terminal hole in the board to facilitate the insertion of the unguided lead.

5 Requirements to taping

5.1 Taping dimensions

Taping dimensions shall be in accordance with Clause 4, Annex A and Annex B. When leads are preformed, the type and dimensions of the forming shall be agreed between the manufacturer and the customer, and shall be given in the component specification.

5.2 Polarity and orientation requirements of components on tape

All polarized components shall be oriented in one direction. The cathode lead and, for transistors (except for TO-92 packages), the emitter lead shall be the last one to leave the package, unless otherwise specified in the detail specification. For TO-92 packages, the flat side shall be on the upper side of the tape.