IEC TR 61188-8

Edition 1.0 2021-01

TECHNICAL REPORT

Circuit boards and circuit board assemblies – Design and use – Part 8: 3D shape data for CAD component library

IEC TR 61188-8:2021-01(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC TR 61188-8

Edition 1.0 2021-01

TECHNICAL REPORT

Circuit boards and circuit board assemblies – Design and use – Part 8: 3D shape data for CAD component library

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 31.180; 31.190

ISBN 978-2-8322-9226-6

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

CIRCUIT BOARDS AND CIRCUIT BOARD ASSEMBLIES – DESIGN AND USE –

Part 8: 3D shape data for CAD component library

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61188-8 has been prepared by IEC technical committee 91: Electronics assembly technology. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
91/1640/DTR	91/1682/RVDTR

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 Technical Report is English.

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.

A list of all parts in the IEC 61188 series, published under the general title *Circuit boards and circuit board assemblies – Design and use*, 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 document 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.

CIRCUIT BOARDS AND CIRCUIT BOARD ASSEMBLIES – DESIGN AND USE –

Part 8: 3D shape data for CAD component library

1 Scope

This part of IEC 61188 describes the configuration of part shape data of semiconductor devices and electrical components registered in the CAD library.

This document mainly describes the configuration of 2D and 3D parts shape data.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

No terms and definitions are listed in this document.

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

3.2 Abbreviated terms

The abbreviations used in this document are shown in Table 1.

Table 1 – Abbreviated terms

Abbreviation	Full word	Note
STEP	Standard for the Exchange of Product Model Data,	The document for the Exchange of Product Model Data is a comprehensive ISO standard (ISO 10303 [all parts]) that describes how to represent and exchange digital product information.
DXF	Drawing Exchange Format	The Drawing Exchange Format is a CAD data file format developed by Autodesk for enabling data interoperability between AutoCAD and other programs.
IGES	Initial Graphics Exchange Specification	The Initial Graphics Exchange Specification is a vendor-neutral file format that allows the digital exchange of information among CAD systems

4 Classification of component shape data

4.1 Classification by technical drawing

The classifications by technical drawing are the following four patterns. The drawing should be managed by agreement between parts manufacturer and equipment manufacturer.

a) 2D drawing;
b) 2D drawing + 3D shape models;
c) 3D models + simplified 2D drawings;
d) 3D annotated models.

4.2 Classification by the kind of component shape data

4.2.1 General

Component shape data distribution are the following three classes. The usage should be managed by an agreement between parts manufacturer and equipment manufacturer.

a) master data;
b) design-use data;
c) complement data.

4.2.2 Master data

The data which are positioned original when there was a difference between plural data.

4.2.3 Design-use data

The design-use data are directly measured and are treated as a nominal value.

4.2.4 Complement data

The complement data are needed as a reference when the design-use data are insufficient for CAD data design.

4.3 Relation between technical drawing and component shape data

The relation between technical drawing and component shape data are shown in Table 2.

Table 2 – Relation between technical drawing and component shape data

Classification		Master data	Design-use data	Complement data
1A	2D drawing	Data sheet	2D drawing	nothing
1B		2D drawing	Same as left	nothing
2A	2D drawing + 3D shape models	Data sheet	2D drawing	3D shape models
2B		Data sheet	3D shape models	2D drawing
2C		2D drawing	2D drawing	3D shape models
3	3D models + simplified 2D drawings	Data sheet	3D models	Simplified 2D drawings
4A	3D annotated models	Data sheet	3D annotated models	nothing
4B		3D annotated models	Same as left	nothing

5 Configuration data of shape data

5.1 General

The configuration data of shape data used in components consists of the factors as listed below. The decision of factors should be managed based on agreement between parts manufacturer and equipment manufacturer.

a) dimensions (see 5.2);
b) material distinction (see 5.3);
c) marking (see 5.4);
d) component identification information (see 5.5);
e) reference point and placement angle (see 5.6);
f) scale (see 5.7);
g) CAD format (see 5.8);
h) component shape levels (see 5.9);
i) other attributes (see 5.10).

5.2 Dimensions

5.2.1 Dimensions of 2D drawing

The dimensions of 2D drawing in all dimensions of the prepared data are basically nominal values.

5.2.2 Dimensions of 3D shape models

The dimensions of 3D shape models are as follows:

a) basically, all dimensions in the data to be prepared should be nominal values;
b) The tolerances with 2D drawing are important to clarify;
c) When the description of the dimension is "1.0+0.3/-0.1", "1.0" is taken as a nominal value.

5.3 Material distinction

To check locations with resin surface and those with metal surface, it is desirable to distinguish them with different colours.

5.4 Marking

If the component has polarity or orientation markings, the markings should not be omitted in the component shape data. An example of marking is shown in Figure 1.

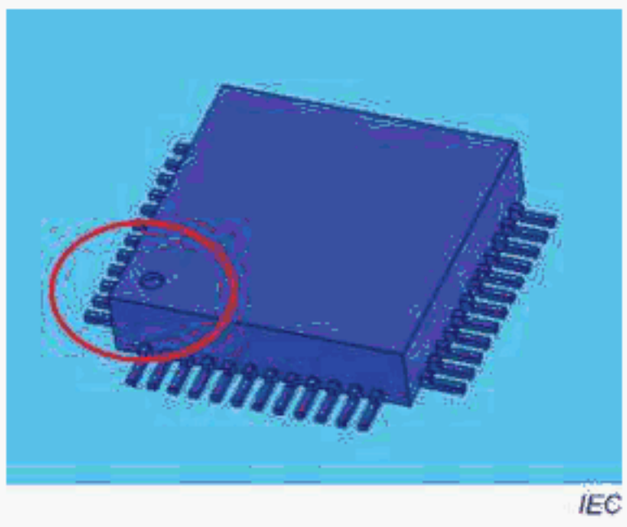


Figure 1 – Marking

5.5 Component identification information

The shape data should be included with identification information for the purpose of retrieval and storage.

Representative items of identification information are shown in items a) to g) below:

a) part number;
b) manufacturer name;
c) manufacturer model name or manufacturer part number;
d) design use data: file name and version;
e) complement data: file name and version;
f) changes;
g) notes.

As for the constitution information, XML should be used as a searchable description format.

5.6 Reference point and placement angle

5.6.1 Rules for 2D drawings

The rules for 2D drawings are as follows:

a) components and land patterns are drawn in top view;
b) the component point of origin is shown by “+” or “x”;
c) A circumscribing rectangle which contains the component body and land patterns (in top view) should be a part of the library component description. This rectangle is the “Courtyard” that provides a minimum electrical and physical clearance for the part and the land pattern. The point of origin of the description should match that of the component and land pattern. The descriptions of the components, land patterns, and circumscribed rectangles, described are the same in the computer library, and each description uses the same origin coordinates. It is recommended that the point of origin is the same as the way the component is positioned on the final design of the board which is normally by the centroid of the component body.

5.6.2 Rules for 3D shape models (component with no moving part)

The rules for 3D shape models (component with no moving part) described are as follows:

a) relation between 2D drawing and 3D shape model;

   It is desirable to design the reference point and placement angle according to the same rules.

b) reference point;

   The center of the outline of the largest rectangle containing the electrodes described are the reference point.

   The sitting plane is considered to have a Z value of 0, and the direction moving below the seating plane is considered the minus direction of the Z-axis.

c) placement angle

   Indicate the polarity so that it is in the minus direction in the X-axis or in the minus directions of both X- and Y-axes. The example of placement angle is shown in Figure 2.

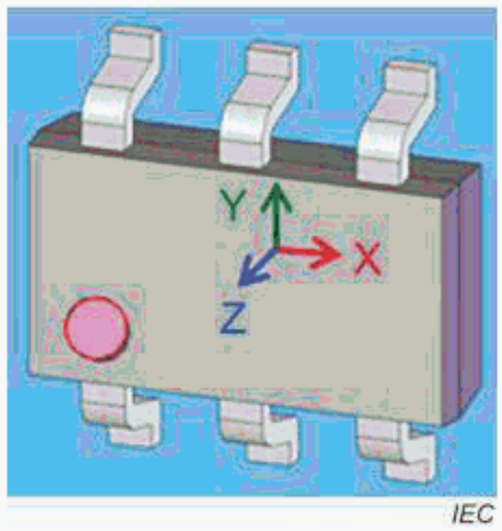


Figure 2 – Reference point and placement angle

5.6.3 Rules for 3D shape models (component with moving part)

5.6.3.1 Connectors

In case of connectors with a moving part, the center of the outline of the largest rectangle containing the electrodes in closed position should be the reference point. The example of placement angle of connectors is shown in Figure 3.

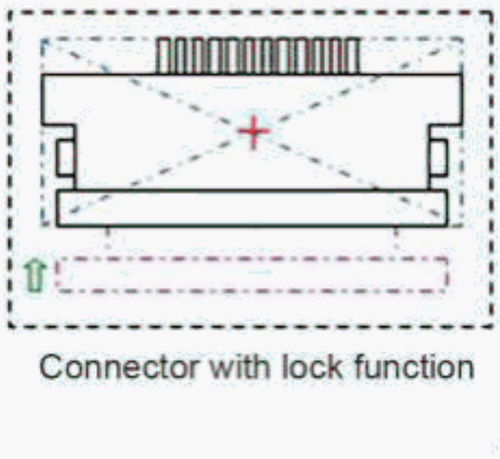


Figure 3 – Placement angle of connectors

5.6.3.2 Switches

In case of switches with a moving part, the center of the outline of the largest rectangle containing the electrodes in delivery position should be the reference point. The example of placement angle of switches is shown in Figure 4.

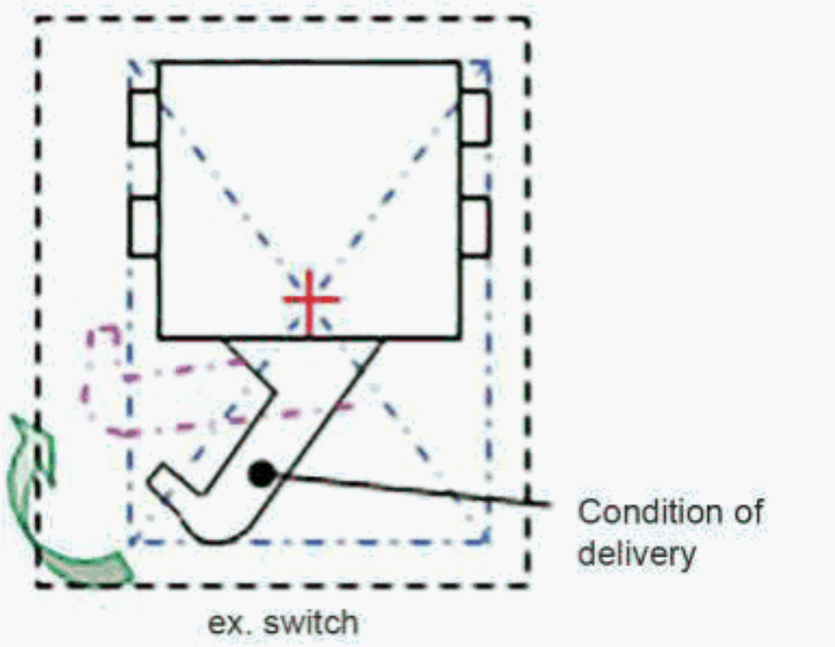


Figure 4 – Placement angle of switches

5.7 Scale

The scale is basically but not necessarily 1/1.

Indicate the scale on the drawing.

5.8 CAD format

5.8.1 2D drawings

The 2D drawing is an acceptable DXF format.

5.8.2 3D shape models

3D shape models are the basically used CAD format of STEP / AP214(solid model). If the format is not available, IGES is acceptable.

5.9 Component shape levels

5.9.1 General

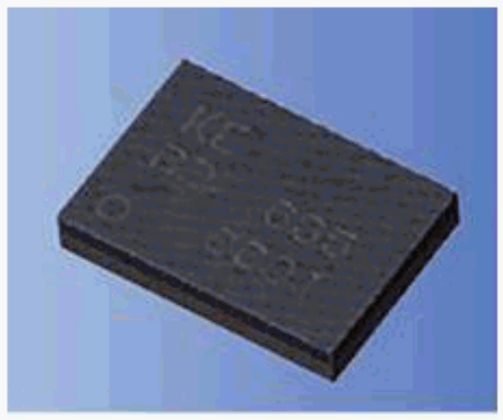
The component shape levels are classified in following four levels according to the usage. The characteristics and the usage of each level are described in 5.9.2 to 5.9.5. Level 4 data are positioned to the component manufacturing and are not circulated in general. Therefore, Level 4 is only an explanation of the classification and does not describe the details of the data specifications.

5.9.2 Level 1

Level 1 shapes are as follows:

a) most simplified model (rectangular solid);
b) the data which likes real shape in top view but structured one dimension in z-axis;.
c) this level model is used for checking component placement and interference roughly.

An example of shapes level 1 is shown in Figure 5.



IEC

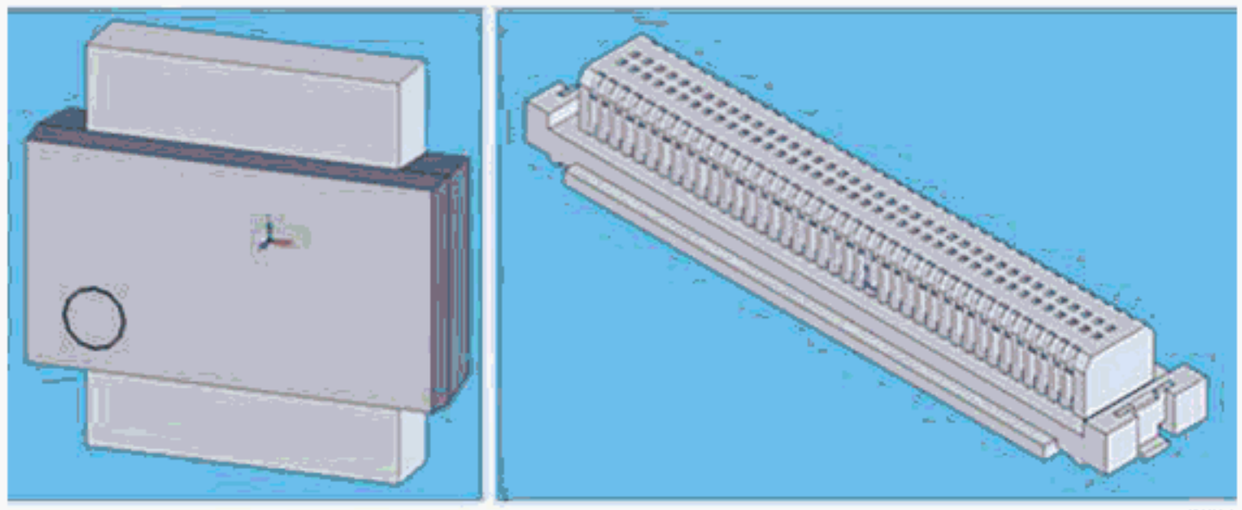
Figure 5 – Example of shape level 1

5.9.3 Level 2

Level 2 shapes are as follows:

a) model generally used for checking component placement and interference, a shape with multi-terminal portions in level 3 being omitted;
b) models simplified portion of termination;
c) this level model is used for checking component placement and interference in general.

Two examples of shapes level 2 are shown in Figure 6.



IC example Connector example

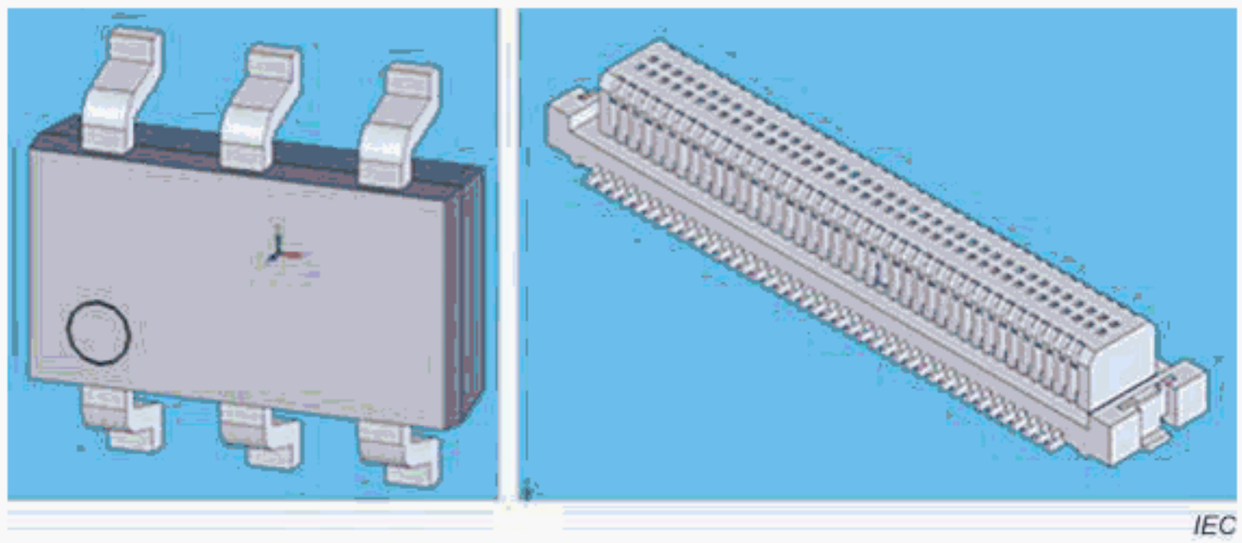
Figure 6 – Examples of shape level 2

5.9.4 Level 3

Level 3 shapes are as follows:

a) model structured by omitting the internal structure from level 4;
b) real shape in terms of appearance including outside dimensions and holes and markings;
c) simplification in shape besides the metallic portion influenced drawing patterns;
d) marking which shows polarity or orientation should not be omitted;
e) this level model is used for land pattern design and checking component placement and interference.

Two examples of shapes level 3 are shown in Figure 7.



IC example Connector example

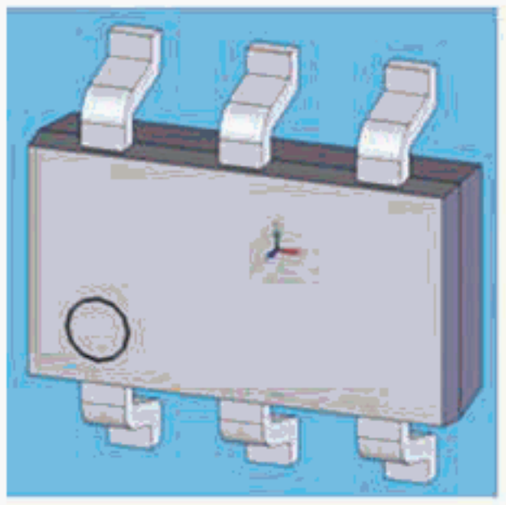
Figure 7 – Examples of shape level 3

5.9.5 Level 4

Level 4 shapes are as follows:

a) model including the internal structure and real shape in terms of appearance including outside dimensions and holes;
b) component design raw data;
c) this level data is not suitable for circulation;
d) this level model is used for component manufacturing.

Examples of shapes level 4 is shown in Figure 8.



IEC

Figure 8 – An example of shape level 4

5.10 Other attributes

5.10.1 Land pattern data

The land pattern data may be added as necessary.

5.10.2 Courtyard data

5.10.2.1 General

The courtyard data may be added as necessary.

The 3D courtyard of 3D model is the smallest cubic area that provides a minimum electrical and mechanical clearance of both the component maximum boundary extremities and/or the land pattern maximum boundary extremities. The intent of 3D courtyard is to aid the designer in determining the minimum cubic area occupied by the combination of component and land pattern.

5.10.2.2 Level 1 data

Level 1 is a shape in which the shape projected from the top of the part rises on the z-axis.

5.10.2.3 Level 2 data

The Level 2 data are simplified in z-axis.

5.10.2.4 Level 3 and Level 4 data

The Level 3 and Level 4 data is real shape in x-y axis and z-axis.

5.10.3 Other attributes data

Other attributes data may be added as necessary.

6 Basic design logic classification for components

The basic design logic classification for components by component shape in SMD and IMD are shown in Table 3 and Table 4.

Table 3 – Basic design logic classification for SMD *(1 of 2)*

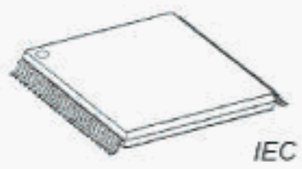
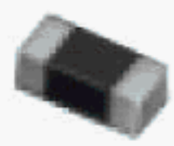
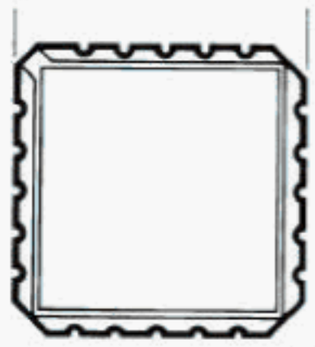
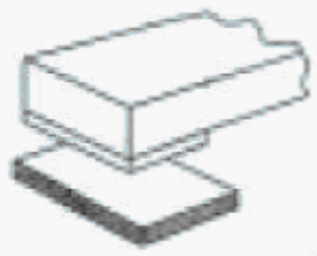
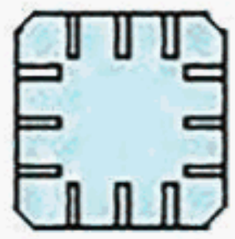
No	Logic title	Component image	Sub-title	Level 1	Level 2	Level 3	Level 4
1	gull-wing terminals	 IEC	General type	rectangular solid	Pin portions integrated	Real shape	Design raw data
2	Flat terminals	 IEC	General type	rectangular solid	Pin portions integrated	Real shape	Design raw data
3	Square-End Terminations	 IEC		rectangular solid	-	Real shape	Design raw data
		 IEC	Surrounding terminations	rectangular solid	Pin portions integrated	Real shape	Design raw data
4	Bottom Only Terminations	 IEC	General type	rectangular solid	-	Real shape	Design raw data
		 IEC	QFN type	rectangular solid	-	Real shape	Design raw data
			SON type	-	-	-	-
		 IEC	BGA type	rectangular solid	Pin portions integrated	Real shape	Design raw data

Table 3 *(2 of 2)*

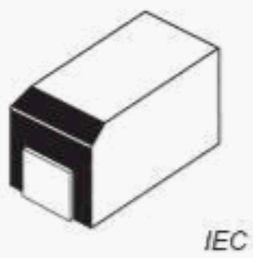
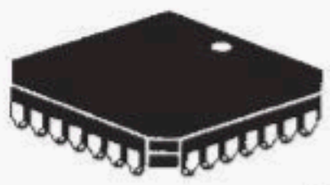
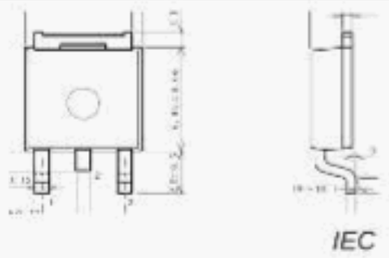
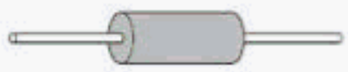
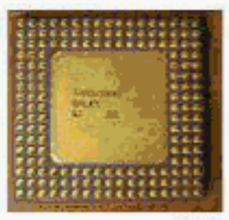
No	Logic title	Component image	Sub-title	Level 1	Level 2	Level 3	Level 4
5 6	Inward L shaped ribbon terminals	 IEC	General type	rectangular solid	-	Real shape	Design raw data
	J-bends	 IEC	General type	rectangular solid	Pin portions integrated	Real shape	Design raw data
7 8	Cylindrical End Terminations	 IEC	General type ~~General type~~	rectangular solid	-	Real shape	Design raw data
	Round or flattened (coined) leads	 IEC		rectangular solid	-	Real shape	Design raw data
9	Mixed terminations (SMD)	 IEC	General type General type	rectangular solid	-	Real shape	Design raw data
10	Mixed terminations (SMD with insertion leads)	 IEC		rectangular solid		Real shape	Design raw data

Table 4 – Basic design logic classification for IMD

No	Logic title	Component image	Sub-title	Level 1	Level 2	Level 3	Level 4
1	Axial type	 IEC	General type	rectangular solid	-	Real shape	Design raw data
2	Radial type	 IEC	General type	rectangular solid	-	Real shape	Design raw data
3	DIP type	IEC	General type	rectangular solid	Pin portions integrated	Real shape	Design raw data
4	PGA type	 IEC	General type	rectangular solid	Pin portions integrated	Real shape	Design raw data
5	TO type	 IEC	General type	rectangular solid	-	Real shape	Design raw data
6	ZIP type	 IEC	General type	rectangular solid	Pin portions integrated	Real shape	Design raw data

Bibliography

IEC 61188-7, *Printed boards and printed board assemblies – Design and use – Part 7: Sectional requirements – Electronic component zero orientation for CAD library construction*

ISO 10303 (all parts), *Industrial automation systems and integration – Product data representation and exchange*

ISO 16792, *Technical product documentation – Digital product definition data practices*

_____