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TECHNICAL REPORT

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

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**CIRCUIT BOARDS AND CIRCUIT BOARD ASSEMBLIES –
DESIGN AND USE –**

Part 8: 3D shape data for CAD component library

FOREWORD

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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.

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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

<table>
<tr><th colspan="2">Classification</th><th>Master data</th><th>Design-use data</th><th>Complement data</th></tr>
<tr><td>1A</td><td rowspan="2">2D drawing</td><td>Data sheet</td><td>2D drawing</td><td>nothing</td></tr>
<tr><td>1B</td><td>2D drawing</td><td>Same as left</td><td>nothing</td></tr>
<tr><td>2A</td><td rowspan="3">2D drawing + 3D shape models</td><td>Data sheet</td><td>2D drawing</td><td>3D shape models</td></tr>
<tr><td>2B</td><td>Data sheet</td><td>3D shape models</td><td>2D drawing</td></tr>
<tr><td>2C</td><td>2D drawing</td><td>2D drawing</td><td>3D shape models</td></tr>
<tr><td>3</td><td>3D models + simplified 2D drawings</td><td>Data sheet</td><td>3D models</td><td>Simplified 2D drawings</td></tr>
<tr><td>4A</td><td rowspan="2">3D annotated models</td><td>Data sheet</td><td>3D annotated models</td><td>nothing</td></tr>
<tr><td>4B</td><td>3D annotated models</td><td>Same as left</td><td>nothing</td></tr>
</table>

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.

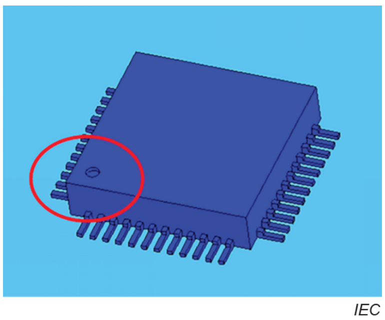

Figure 1 – Marking

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.

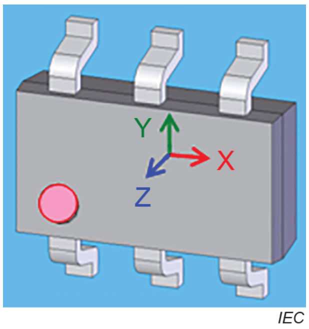

Figure 2 – Reference point and placement angle

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.

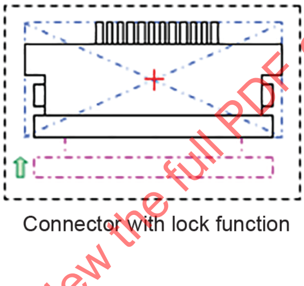

Figure 3 – Placement angle of connectors

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.

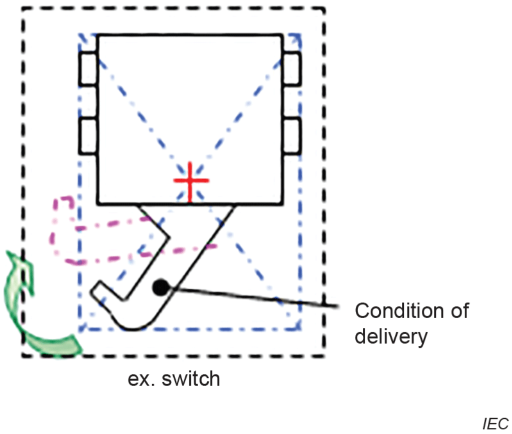

Figure 4 – Placement angle of switches

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.

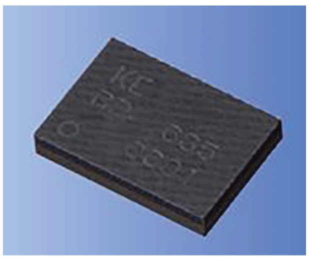

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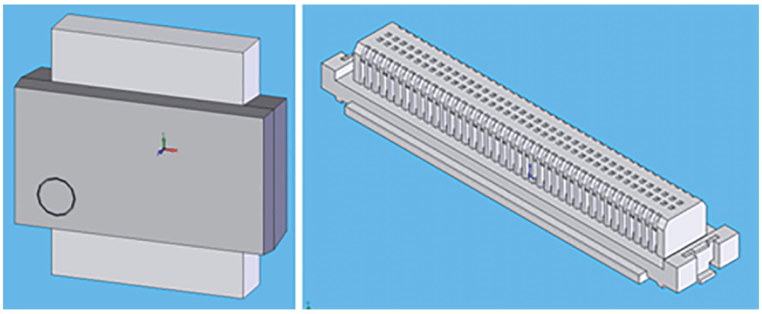
Figure 5 – Example of shape level 1

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.



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IC example Connector example

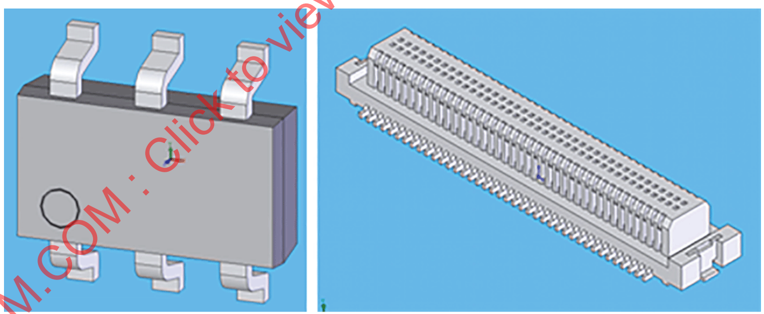
Figure 6 – Examples of shape level 2

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.



IEC

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.

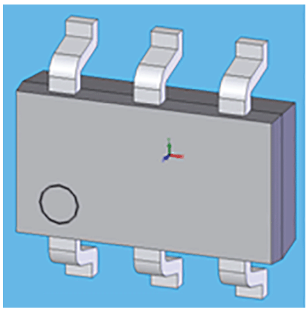

IEC

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)*

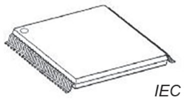
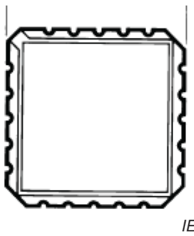
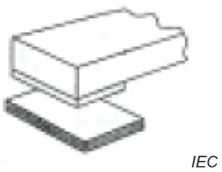
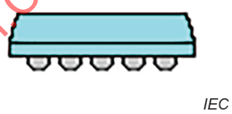
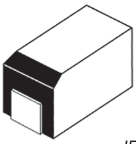
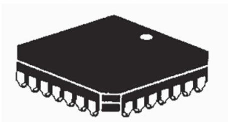
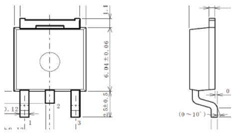
No	Logic title	Component image	Sub-title	Level 1	Level 2	Level 3	Level 4
1	gull-wing terminals		General type	rectangular solid	Pin portions integrated	Real shape	Design raw data
2	Flat terminals		General type	rectangular solid	Pin portions integrated	Real shape	Design raw data
3	Square-End Terminations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