Intermediate Data Format

Mechanical Data Exchange Specification
for the Design and Analysis of
Printed Wiring Assemblies

Version 3.0

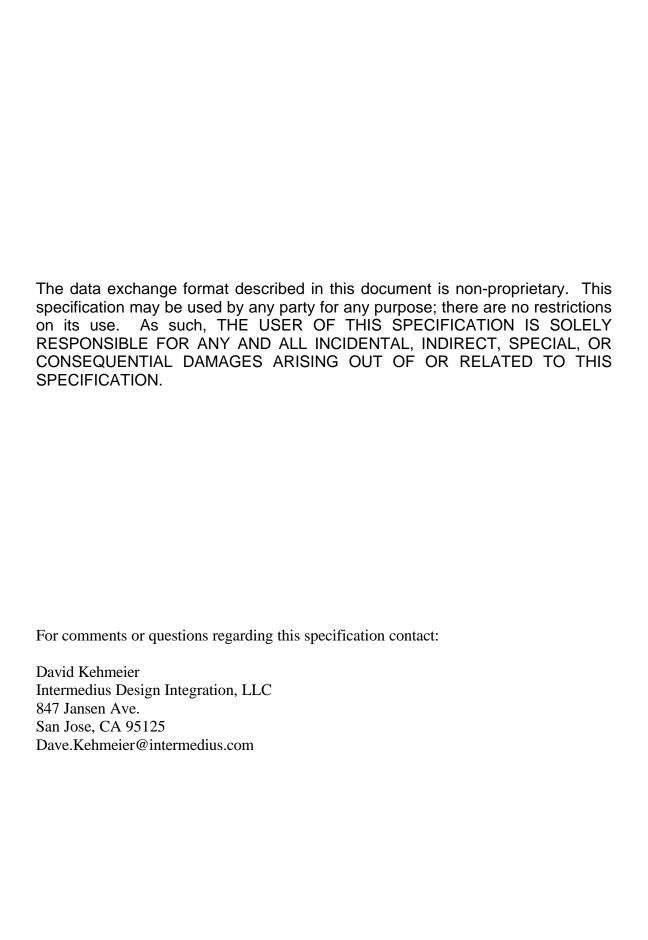### Revision 1
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1.0   Introduction

This specification defines an Intermediate Data Format (IDF) for exchanging data between electrical and mechanical CAD/CAE systems for use in 3D design and analysis of printed wiring assemblies (PWAs), thus allowing users of these systems to participate concurrently in the design of electro-mechanical products. In a typical electro-mechanical design process for example, a mechanical CAE system may require a solid model of a PWA for form fit analysis in designing the enclosure for the final product. The electrical CAE system, on the other hand, requires 2D board outline and critical component placement information to layout and route the PWA design.

1.1   Scope

Limitations inherent in the systems that exchange data using this IDF may affect the interpretation of the data it contains. For example, a receiving system may not contain a data type for simple closed curves that include arcs. As a result, that system's translator may break up the arcs into a series of line segments. As another example, the current version of a translator may not be able to read or write all types of data contained in this version of the IDF. This specification does not attempt to describe these limitations; it is the responsibility of translator developers to communicate any such limitations to their users.

This specification does not address change management or configuration control of the IDF files. Change management and configuration control is the responsibility of the translators that read and write this format.

1.2   Summary of Changes, Version 3.0

A number of changes have been made to the Intermediate Data Format for Version 3.0:

- A new optional file, the Panel File, was added to allow the exchange of manufacturing panel information. The Panel File may contain any of the sections supported by the Board File. This allows panels to have keepouts, keepins, and drilled holes, for example.

- Ten nanometer units (TNM) are no longer supported.

- A new section, .NOTES, was added to the Board and Panel File to allow the exchange of design information and instructions that are not otherwise conveyed by IDF entities. The notes are intended for informational purposes only, not for use in manufacturing drawings.

- A new field was added to the first record of each section (except the drilled holes and notes sections) to specify which system, electrical or mechanical, "owns" that entity.

- A new field was added to the other outline section to specify which side the part represented by the other outline is mounted.

- Circular cutouts can now be represented by an included angle of 360.

- A new record was added to the routing outline section to allow routing outlines to be defined per layer.

- A new record was added to the placement outline section to allow placement outlines to be defined per side.

- New fields were added to the drilled hole record to specify how the hole is used and which system, electrical or mechanical, "owns" the hole.

- A field for representing the mounting offset for a component was added to the placement section.

- New values were added to the placement status field in the placement section to specify which system, electrical or mechanical, "owns" the placement of a particular component.

- A new record, beginning with keyword PROP, was added to the electrical section of the Library File to allow property information for components to be represented.

2.0   Structure of the Intermediate Data Format

The Intermediate Data Format consists of three files: the Board File, the Library File and the Panel File. The Board File contains a description of a single PWA, including the board shape, layout restrictions, and component placement. The Library File contains descriptions of components used by one or more PWAs. The Panel file contains a description of a manufacturing panel including the panel shape, layout restrictions, and the placement of boards and components on the panel.

Data is organized by sections in these files. Each section begins with a keyword indicating the type of data the section contains, and a matching keyword at the end of the section. All data between the section keyword and its corresponding ending keyword pertains to that section. Sections cannot be nested. Unless otherwise noted, sections within a file can be in any order.

Data within the sections is represented by one or more records consisting of one or more fields. Each line in a file is a separate record; fields within a record are separated by one or more blanks. Records within a section and fields within a record must be in a specific order. Records are free format which means that the fields they contain can be any length, and each field can begin in any column as long as the order of fields is maintained.

2.1   General Format Rules

The following general rules apply to the Intermediate Data Format:

- Sections are delimited by keywords beginning with a period (.).

- Records are delimited by a single new line character.

- Fields within a record are delimited by one or more space characters.

- Records and fields can be any length.

- Three data types are supported: string, float, and integer.

- Strings containing blank characters must be delimited by surrounding them with double quotes (").

- Keyword strings are not case sensitive; they are generally capitalized to enhance readability.

- The case sensitivity of value strings is determined by the sending and receiving systems. Therefore, it is best to maintain the case of value strings.

- The comment character is the pound sign (#). A comment must be a separate line (record) and the comment character must be in column 1. Comments should be located between, but not within sections of the IDF files.

3.0   Board, Panel File Format

The Board File contains the physical description of the PWA itself and the locations of components that are placed on the board. The physical descriptions for the components are contained in the Library File and referenced in the placement section of the Board File.

NEW!   The Panel File is an optional file, similar to the Board File, that contains the physical description of a manufacturing step-and-repeat panel and the locations of boards and components on that panel. The Panel File references one or more PWAs described in separate Board Files. Any component placed on the panel itself is referenced in a Library File.

The Board and Panel Files contains the following sections:

- **Header**   for information on the Board or Panel File itself
- **Board outline**   for defining the outline, cutouts, and thickness of the board, panel
- **Other outline**   for defining the outline, cutouts, and thickness of another outline
- **Route outline**   for defining an area to route electrical connections within
- **Place outline**   for defining an area to place electrical components within
- **Route keepout**   for defining an area within which routing is not allowed
- **Via keepout**   for defining an area within which vias are not allowed
- **Place keepout**   for defining an area within which electrical components are not allowed
- **Place region**   for defining an area to place similar electrical components within
- **Drilled holes**   for defining drilled holes in the board, panel
- **Notes**   for defining annotations to communicate additional information among designers
- **Placement**   for defining the locations of components on the board, or boards and components on the panel

The Header section must be the first section in the file, the second section must be the Outline section, and the last section must be the Placement section. All other sections may be in any order.

The following pages describe these sections.

3.1   Header Section

This section contains information on the Board or Panel File itself.

	Field, Description	Type	Value
1	Section keyword	string	.HEADER

Record 2

	Field, Description	Type	Value	
1	File type	string	BOARD_FILE	File contains board information
			PANEL_FILE	File contains panel information
2	IDF version number	float	1.0	First version
			2.0	Previous version
			3.0	This version
3	Source system identification	string	Any	Example: "ACME CAD rel. 5.0"
4	Date	string	format = yyyy/mm/dd.hh:mm:ss	
5	Board File version #	integer	Any	

NEW! (for field 1)

NEW! (for field 2)

Record 3

	Field, Description	Type	Value	
1	Board name	string	Any	
2	Units definition	string	MM	millimeters
			THOU	mils (thousandths of an inch)

The units specified in Field 2 apply to all values in the Board or Panel File.

Record 4

	Field, Description	Type	Value
1	Section end keyword	string	.END_HEADER

3.2   Board, Panel Outline Section

This section defines the board or panel outline and its internal cutouts as a 2D profile with thickness. The outline and cutouts consist of simple closed curves made up of arcs and lines. Only one outline may be specified, but multiple cutouts are allowed.

Record 1

	Field, Description	Type	Value	
1	Section keyword	string	.BOARD_OUTLINE .PANEL_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and should not be modified in the Electrical system
			ECAD	Outline is owned by the Electrical system and should not be modified in the Mechanical system
			UNOWNED	Outline can be modified in either system

NEW! (for Field 1)
NEW! (for Field 2)

Record 2

	Field, Description	Type	Value
1	Thickness	float	Any

The thickness of a panel should be the same as the boards it contains.

Record 3

	Field, Description	Type	Value	
1	Loop label	integer	0	Indicates board outline (points specified in counter-clockwise direction)
			1	Indicates board cutout (points specified in clockwise direction)
			n	Indicates additional board cutouts labeled sequentially from one
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	
4	Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
			_ 0	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
			360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

NEW! (for Field 4)

Record 3 is repeated for each point that defines the outline or a cutout. For each loop (outline or cutout), the last pair of coordinates should be the same as the first.

Record 4

NEW!

	Field, Description	Type	Value
1	Section end keyword	string	.END_BOARD_OUTLINE .END_PANEL_OUTLINE

3.3 Other Outline Section

This section defines an additional outline with cutouts that can be used for other purposes than the board outline such as for defining a heatsink or board core. The outline and cutouts consist of simple closed curves made up of arcs and lines. Multiple other outline sections may be specified.

Record 1

	Field, Description	Type	Value	
1	Section keyword	string	.OTHER_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and should not be modified in the Electrical system
			ECAD	Outline is owned by the Electrical system and should not be modified in the Mechanical system
			UNOWNED	Outline can be modified in either system

(NEW! marker beside field 2)

Record 2

	Field, Description	Type	Value	
1	Outline identifier	string	Any	Unique identifier for the outline, such as a part name or layer name
2	Extrude thickness	float	Any ($\geq$0)	
3	board side	string	TOP	Other outline is on top of the board
			BOTTOM	Other outline is on the bottom of the board

(NEW! marker beside field 3)

Record 3

	Field, Description	Type	Value	
1	Loop label	integer	0	Indicates outline (points specified in counter-clockwise direction)
			1	Indicates cutout (points specified in clockwise direction)
			n	Indicates additional cutouts labeled sequentially from one
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	
4	Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
			$\neq$ 0	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
			360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

(NEW! marker beside field 4)

Record 3 is repeated for each point that defines the outline or its cutouts. For each loop (outline or cutout), the last pair of coordinates should be the same as the first.

Record 4

	Field, Description	Type	Value
1	Section end keyword	string	.END_OTHER_OUTLINE

3.4   Routing Outline Section

This section defines a routing outline for the board or panel. Each routing outline specifies a region within which routing must be confined, and consists of a simple closed curve made up of arcs and lines. Portions of routing outlines on a panel that lie on a board in the panel are inherited by that board. Multiple routing outlines may be defined.

Record 1

	Field, Description	Type	Value	
1	Section keyword	string	.ROUTE_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and should not be modified in the Electrical system
			ECAD	Outline is owned by the Electrical system and should not be modified in the Mechanical system
			UNOWNED	Outline can be modified in either system

NEW! (next to Record 1, field 2)

NEW! ### Record 2

	Field, Description	Type	Value	
1	Routing layers	string	TOP	Outline applies to top routing layer only
			BOTTOM	Outline applies to bottom routing layer only
			BOTH	Outline applies to both top and bottom routing layers only
			INNER	Outline applies to the inner routing layers of the board only
			ALL	Outline applies to all routing layers

Record 3

	Field, Description	Type	Value	
1	Loop label	integer	0	Indicates points specified in counter-clockwise direction
			1	Indicates points specified in clockwise direction
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
			_ 0	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
			360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

NEW! (next to Record 3, field 4, value 360)

Record 3 is repeated for each point that defines the routing outline. The last pair of coordinates should be the same as the first.

Record 4

	Field, Description	Type	Value
1	Section end keyword	string	.END_ROUTE_OUTLINE

3.5   Placement Outline Section

This section defines a placement outline for the board or panel. Each placement outline specifies a region within which components must be placed, and consists of a simple closed curve made up of arcs and lines plus a height restriction. Portions of placement outlines on a panel that lie on a board in the panel are inherited by that board. Multiple placement outlines may be defined.

Record 1

Field, Description		Type	Value	
1	Section keyword	string	.PLACE_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and should not be modified in the Electrical system
			ECAD	Outline is owned by the Electrical system and should not be modified in the Mechanical system
			UNOWNED	Outline can be modified in either system

NEW! (beside Field 2)

NEW! ### Record 2

Field, Description		Type	Value	
1	Board side	string	TOP	Outline applies to top side of board only
			BOTTOM	Outline applies to bottom side of board only
			BOTH	Outline applies to both sides of board
2	Outline height	float	Any (³0)	

The outline height is used to exclude components from the outline that, when mounted, exceed this height. If this field is missing, there is no height restriction on the outline.

Record 3

Field, Description		Type	Value	
1	Loop label	integer	0	Indicates points specified in counter-clockwise direction
			1	Indicates points specified in clockwise direction
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
			_ 0	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
			360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

NEW! (beside Field 4)

Record 3 is repeated for each point that defines the placement outline. The last pair of coordinates should be the same as the first.

Record 4

	Field, Description	Type	Value
1	Section end keyword	string	.END_PLACE_OUTLINE

3.6   Routing Keepout Section

This section defines a routing keepout for the board or panel. Routing keepouts specify regions where routing is not allowed. Routing keepouts can exist on top, bottom, both top and bottom, or all routing layers. Each keepout consists of a simple closed curve made up of arcs and lines. Portions of routing keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple keepouts are allowed.

Record 1

	Field, Description	Type	Value	
1	Section keyword	string	.ROUTE_KEEPOUT	
2	Keepout owner	string	MCAD	Keepout is owned by the Mechanical system and should not be modified in the Electrical system
			ECAD	Keepout is owned by the Electrical system and should not be modified in the Mechanical system
			UNOWNED	Keepout can be modified in either system

NEW! (for field 2)

Record 2

	Field, Description	Type	Value	
1	Routing layers	string	TOP	Keepout applies to top routing layer only
			BOTTOM	Keepout applies to bottom routing layer only
			BOTH	Keepout applies to both top and bottom routing layers only
			INNER	Outline applies to the inner routing layers of the board only
			ALL	Keepout applies to all routing layers

NEW!

Record 3

	Field, Description	Type	Value	
1	Loop label	integer	0	Indicates points specified in counter-clockwise direction
			1	Indicates points specified in clockwise direction
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
			_ 0	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
			360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

NEW!

Record 3 is repeated for each point that defines the routing keepout. The last pair of coordinates should be the same as the first.

Record 4

	Field, Description	Type	Value
1	Section end keyword	string	.END_ROUTE_KEEPOUT

3.7 Via Keepout Section

This section defines a via keepout for the board or panel. Via keepouts specify regions where vias are not allowed (although routing is still allowed). Each keepout consists of a simple closed curve made up of arcs and lines. Portions of via keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple via keepouts are allowed. Only through vias (vias that go all the way through the board) are supported.

Record 1

	Field, Description	Type	Value	
1	Section keyword	string	.VIA_KEEPOUT	
2	Keepout owner	string	MCAD	Keepout is owned by the Mechanical system and should not be modified in the Electrical system
			ECAD	Keepout is owned by the Electrical system and should not be modified in the Mechanical system
			UNOWNED	Keepout can be modified in either system

NEW! (beside field 2)

Record 2

	Field, Description	Type	Value	
1	Loop label	integer	0	Indicates points specified in counter-clockwise direction
			1	Indicates points specified in clockwise direction
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
			_ 0	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
			360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

NEW! (beside field 4)

Record 2 is repeated for each point that defines the via keepout. The last pair of coordinates should be the same as the first.

Record 3

	Field, Description	Type	Value
1	Section end keyword	string	.END_VIA_KEEPOUT

3.8 Placement Keepout Section

This section defines a placement keepout for the board or panel. Placement keepouts specify regions on the board where components cannot be placed. A keepout can apply to all components, or to only those components above a specified height. Placement keepouts can exist on the top, bottom, or both top and bottom of the board or panel. Each keepout consists of a simple closed curve made up of arcs and lines along with a height restriction. Portions of placement keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple keepouts are allowed.

Record 1

NEW!

	Field, Description	Type	Value	
1	Section keyword	string	.PLACE_KEEPOUT	
2	Keepout owner	string	MCAD	Keepout is owned by the Mechanical system and should not be modified in the Electrical system
			ECAD	Keepout is owned by the Electrical system and should not be modified in the Mechanical system
			UNOWNED	Keepout can be modified in either system

Record 2

	Field, Description	Type	Value	
1	Board side	string	TOP	Keepout applies to top side of board only
			BOTTOM	Keepout applies to bottom side of board only
			BOTH	Keepout applies to both sides of board
2	Keepout height	float	Any (≥ 0)	

The keepout height is used to exclude components from the keepout that, when mounted, exceed this height. A value of 0.0 indicates that all components are to be excluded from the keepout.

Record 3

NEW!

	Field, Description	Type	Value	
1	Loop label	integer	0	Indicates points specified in counter-clockwise direction
			1	Indicates points specified in clockwise direction
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
			$\neq 0$	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
			360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the placement keepout. The last pair of coordinates should be the same as the first.

Record 4

Field, Description		Type	Value
1	Section end keyword	string	.END_PLACE_KEEPOUT

3.9   Placement Group Area Section

This section specifies an area where a group of related components is to be placed. For example, it may be desirable to place all analog components in a particular area for thermal considerations. Each placement group area consists of a simple closed curve made up of arcs and lines along with a name designating the group of components to be placed in that area. Multiple areas are allowed.

Record 1

	Field, Description	Type	Value	
1	Section keyword	string	.PLACE_REGION	
2	Region owner	string	MCAD	Region is owned by the Mechanical system and should not be modified in the Electrical system
			ECAD	Region is owned by the Electrical system and should not be modified in the Mechanical system
			UNOWNED	Region can be modified in either system

NEW! appears beside field 2 (Region owner).

Record 2

	Field, Description	Type	Value	
1	Board side	string	TOP	Group area applies to top side of board only
			BOTTOM	Group area applies to bottom side of board only
			BOTH	Group area applies to both sides of board
2	Component group name	string	Any	

Record 3

	Field, Description	Type	Value	
1	Loop label	integer	0	Indicates points specified in counter-clockwise direction
			1	Indicates points specified in clockwise direction
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
			_ 0	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
			360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

NEW! appears beside field 4 (Include angle).

Record 3 is repeated for each point that defines the placement group area. The last pair of coordinates should be the same as the first.

Record 4

	Field, Description	Type	Value
1	Section end keyword	string	.END_PLACE_REGION

3.10 Drilled Holes Section

This section specifies holes that are to be drilled in the board. Drilled holes are distinguished from circular cutouts in the board outline in that they are always drilled (as opposed to punched or routed) and may be plated with conductor. This section only appears once in the Board File, but multiple, non-overlapping holes are allowed.

Record 1

	Field, Description	Type	Value
1	Section keyword	string	.DRILLED_HOLES

Record 2

	Field, Description	Type	Value	
1	Hole diameter	float	Any	
2	X coordinate of center	float	Any	
3	Y coordinate of center	float	Any	
4	Plating style	string	PTH	Plated (conducting) through hole
			NPTH	Non-plated (non-conducting) through hole
5	Associated part	string	BOARD	Indicates that hole is defined in board part
			NOREFDES	Indicates that hole is defined in a non-electrical part
			PANEL	Indicates that hole is defined in panel part
			Reference Designator	Reference designator of the electrical component in which hole is defined
6	Hole type	string	PIN	Hole is associated with a component pin
			VIA	Hole is associated with a conductive via
			MTG	Hole is used for mounting purposes
			TOOL	Hole is used for tooling purposes
			Other	User-defined
7	Hole owner	string	MCAD	Hole is owned by the Mechanical system and should not be modified in the Electrical system
			ECAD	Hole is owned by the Electrical system and should not be modified in the Mechanical system
			UNOWNED	Hole can be modified in either system

NEW! (next to field 5)
NEW! (next to field 6)
NEW! (next to field 7)

All X and Y coordinate values are absolute (relative to the board or panel origin).

Record 2 is repeated for each drilled hole represented.

Record 3

	Field, Description	Type	Value
1	Section end keyword	string	.END_DRILLED_HOLES

3.11 Notes Section

NEW! This section contains notes for the design that can be displayed in the receiving system, to allow the electrical and mechanical designers to communicate additional information about the design entities beyond that conveyed by the entities themselves. Notes are not intended to be used for rigorous translations of text such as for transferring manufacturing drawings. The association of a note to its subject is inferred by its location.

Record 1

Field, Description	Type	Value
1	Section keyword	string	.NOTES

Record 2

Field, Description	Type	Value	
1	X coordinate of text	float	Any	Bottom left justification is assumed
2	Y coordinate of text	float	Any	Bottom left justification is assumed
3	Text height	float	Any	Board or panel units are assumed
4	Text string physical length	float	Any	Board or panel units are assumed
5	Text value	string	Any	

Record 3

Field, Description	Type	Value
1	Section end keyword	string	.END_NOTES

3.12 Component Placement Section

This section specifies the locations of all components on the board, and boards and components on a panel. A location consists of an X coordinate and Y coordinate relative to the board or panel origin, a mounting offset, a rotation about the component's origin, and a side of the board or panel. Components can be either placed or unplaced. Placed components can be "owned" by the system (electrical or mechanical) that specified their locations to prevent changes to be made to their placement in the receiving system.

The package name and part number fields in Record 2 for each component are used to reference the component's description in the Library File.

Record 1

Field, Description		Type	Value
1	Section keyword	string	.PLACEMENT

Record 2

Field, Description		Type	Value	
1	Package name	string	Any	Part name for package geometry
2	Part number	string	Any	Component part number
3	Reference designator	string	Any	Electrical component instance reference designator
			NOREFDES	Indicates that component instance is a mechanical component
			BOARD	Indicates that instance is a board on a panel

NEW!

Record 3

Field, Description		Type	Value	
1	X coordinate of location	float	Any	
2	Y coordinate of location	float	Any	
3	Mounting offset	float	Any (^{3}0)	Mounting offset from board surface
4	Rotation angle (degrees)	float	Any	
5	Side of board	string	TOP	Component is placed on the top of the board or panel; Board is topside up on panel
			BOTTOM	Component is placed on the bottom of the board or panel; Board is topside down on panel (mirrored about Y axis)
6	Placement status	string	PLACED	Component is placed but can be modified in either system
			UNPLACED	Component is currently unplaced
			MCAD	Component location is fixed and can only be modified in the Mechanical system
			ECAD	Component location is fixed and can only be modified in the Electrical system

NEW! (Record 3, field 3)

NEW! (MCAD)

NEW! (ECAD)

A component is located by first moving its origin to the specified X,Y coordinates (All X and Y coordinate values are absolute, relative to the board or panel origin). Then, if the component is on the bottom of the board or panel, it is flipped around its local Y axis. Finally, the component is rotated the specified amount about its origin (positive rotations are counter-clockwise, relative to the component's coordinated system). See Figure 1.

Component on top, rotated 45°   Component on bottom, rotated 45°

Figure 1

If the value of field 6 of record 3 is "UNPLACED", the values in fields 1-5 are ignored.

Records 2 and 3 are repeated for each component on the board.

Record 4

Field, Description	Type	Value
1 Section end keyword	string	.END_PLACEMENT

4.0   Library File Format

The Library File contains definitions for each unique electrical and mechanical component (based on part number) used in the PWA.   The component definitions in the Library File are referenced by their part numbers in the Board File.

Each component definition includes an outline and height which can be used by the receiving mechanical system to extrude approximate solid models of the components. Detailed models of some or all of the components may be substituted for the extruded shapes in the mechanical system. Note that the ability to perform this substitution is a function of the mechanical system, not the IDF itself.

The Library File contains the following sections:

- **Header**   for information on the Library File itself
- **Electrical**   for defining an electrical component
- **Mechanical**   for defining a mechanical component

The Header section must be the first section in the file; Electrical and Mechanical sections can be in any order after the Header section.

The following pages describe these sections.

4.1   Header Section

This section contains information on the Library File itself.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.HEADER

Record 2

NEW!

Field, Description		Type	Value	
1	File type	string	LIBRARY_FILE	
2	IDF version number	float	1.0 2.0 3.0	First version Previous version This version
3	Source system identification	string	Any	Example: "ACME CAD rel. 5.0"
4	Date	string	format = yyyy/mm/dd.hh:mm:ss	
5	Library File version #	integer	Any	

Record 3

Field, Description	Type	Value
1 Section end keyword	string	.END_HEADER

4.2   Electrical Component Section

This section defines an electrical component that is to be placed on the PCB. An electrical component is defined as being electrically connected to other electrical components in the PWA, such as resistors, connectors and IC components. The outline of an electrical component consists of a simple closed curve made up of arcs and lines. The Library File contains an electrical component section for each electrical part number used in the PWA.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.ELECTRICAL

Record 2

Field, Description	Type	Value	
1 Geometry name	string	Any	
2 Part number	string	Any	
3 Units definition	string	MM	millimeters
		THOU	mils (thousandths of an inch)
4 Component height	float	Any	

The units definition applies to this component only.

The value contained in field 4 is interpreted as the height of the component at 0 mounting offset.

Record 3

Field, Description	Type	Value	
1 Loop label	integer	0	Indicates points specified in counter-clockwise direction
		1	Indicates points specified in clockwise direction
2 X coordinate of point	float	Any	Relative to the component origin
3 Y coordinate of point	float	Any	Relative to the component origin
4 Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
		_ 0	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
		360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

NEW!

Record 3 is repeated for each point that defines the component outline. The last pair of coordinates should be the same as the first.

Record 4

	Field, Description	Type	Value
1	Section end keyword	string	.END_ELECTRICAL

4.2.1 Component Property Record

NEW! This is an optional record that specifies properties for the component. Property records must follow the component outline records (record 3 above) and should be grouped.

	Field, Description	Type	Value	
1	Property keyword	string	PROP	
2	Property name	string	CAPACITANCE	Capacitance, microfarads
			RESISTANCE	Resistance, ohms
			TOLERANCE	Tolerance, % deviation
			POWER_OPR	Operating power rating, Milliwatts
			POWER_MAX	Maximum power rating, Milliwatts
			THERM_COND	Thermal conductivity, Watt/meter_C
			THETA_JB	Junction to board thermal resistance, _C/Watt
			THETA_JC	Junction to case thermal resistance, _C/Watt
			Other	User-defined
3	Property value	Property specific	Any	

4.3   Mechanical Component Section

This section defines a mechanical component that is to be placed on the PCB. A mechanical component has no electrical connectivity to other components in the PWA. Examples of mechanical components include card extractors, stiffeners, and mounting hardware. The outline of a mechanical component consists of a simple closed curve made up of arcs and lines. The Library File contains a mechanical component section for each mechanical part number in the PWA.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.MECHANICAL

Record 2

Field, Description	Type	Value	
1 Geometry name	string	Any	
2 Part number	string	Any	
3 Units definition	string	MM	millimeters
		THOU	mils (thousandths of an inch)
4 Component height	float	Any	

The units definition applies to this component only.

The value contained in field 4 is interpreted as the height of the component at 0 mounting offset.

Record 3

Field, Description	Type	Value	
1 Loop label	integer	0	Indicates points specified in counter-clockwise direction
		1	Indicates points specified in clockwise direction
2 X coordinate of point	float	Any	Relative to the component origin
3 Y coordinate of point	float	Any	Relative to the component origin
4 Include angle (degrees)	float	0	Indicates that a straight line is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N.
		_ 0	Indicates an arc is to be created between X_{N-1}, Y_{N-1} and X_N, Y_N. If positive, the arc is counter-clockwise.
		360	Indicates a circle is to be created with center at X_{N-1}, Y_{N-1} with X_N, Y_N a point on the circle. A circle is considered an entire loop.

NEW!

Record 3 is repeated for each point that defines the component outline. The last pair of coordinates should be the same as the first.

Record 4

	Field, Description	Type	Value
1	Section end keyword	string	.END_MECHANICAL

5.0   Panel File Example

```
.HEADER
PANEL_FILE  3.0  "Sample File Generator"  10/22/96.16:20:19  1
sample_panel    THOU
.END_HEADER
.PANEL_OUTLINE          MCAD
62.0
0       0.0     0.0     0.0
0   16000.0     0.0     0.0
0   16000.0 12000.0     0.0
0       0.0 12000.0     0.0
0       0.0     0.0     0.0
.END_PANEL_OUTLINE
.PLACE_KEEPOUT          MCAD
BOTTOM          0.0
0   13500.0     0.0     0.0
0   16000.0     0.0     0.0
0   16000.0 12000.0     0.0
0   13500.0 12000.0     0.0
0   13500.0     0.0     0.0
.END_PLACE_KEEPOUT
.PLACE_KEEPOUT          MCAD
BOTTOM          0.0
0       0.0     0.0     0.0
0    2200.0     0.0     0.0
0    2200.0 12000.0     0.0
0       0.0 12000.0     0.0
0       0.0     0.0     0.0
.END_PLACE_KEEPOUT
.DRILLED_HOLES
   250.0 15500.0 11500.0    NPTH    PANEL    TOOL    MCAD
   250.0   500.0 11500.0    NPTH    PANEL    TOOL    MCAD
   250.0   500.0   500.0    NPTH    PANEL    TOOL    MCAD
.END_DRILLED_HOLES
.PLACEMENT
   sample_board        pn-board              BOARD
 1700.0  3300.0     0.0     0.0     TOP    MCAD
   sample_board        pn-board              BOARD
14000.0  3300.0     0.0     0.0  BOTTOM    MCAD
.END_PLACEMENT
```

6.0   Board File Example

```
.HEADER
BOARD_FILE  3.0  "Sample File Generator"  10/22/96.16:02:44  1
sample_board  THOU
.END_HEADER
.BOARD_OUTLINE       MCAD
62.0
0    5030.5  -120.0    0.0
0    5187.5  -120.0    0.0
0    5187.5  2130.0    0.0
0    5155.0  2130.0    0.0
0    5155.0  2550.0  -180.0
0    5187.5  2550.0    0.0
0    5187.5  4935.0    0.0
0    4945.0  5145.0    0.0
0    4945.0  5420.0    0.0
0    4865.0  5500.0    0.0
0     210.0  5500.0    0.0
0     130.0  5420.0    0.0
0     130.0  5145.0    0.0
0    -112.5  4935.0    0.0
0    -112.5  2550.0    0.0
0     -80.0  2550.0    0.0
0     -80.0  2130.0  -180.0
0    -112.5  2130.0    0.0
0    -112.5  -140.0    0.0
0      45.5  -140.0    0.0
0      45.5  -400.0    0.0
0    2442.5  -400.0    0.0
0    2442.5  -140.0    0.0
0    2631.5  -140.0    0.0
0    2631.5  -400.0    0.0
0    5030.5  -400.0    0.0
0    5030.5  -120.0    0.0
1    2650.0  2350.0    0.0
1    3000.0  2350.0  360.0
.END_BOARD_OUTLINE
.ROUTE_OUTLINE        ECAD
ALL
0    5112.5   150.0    0.0
0    5112.5  2058.2    0.0
0    5112.5  2621.8  -162.9
0    5112.5  4863.2    0.0
0    4878.8  5075.0    0.0
0     226.4  5075.0    0.0
0     138.0  4910.3    0.0
0     138.0  4800.0    0.0
0     -37.5  4662.5    0.0
0     -37.5  2621.8    0.0
0     -37.5  2058.2  -162.9
0     -37.5   150.0    0.0
0     162.5     0.0    0.0
0    4912.5     0.0    0.0
0    5112.5   150.0    0.0
.END_ROUTE_OUTLINE
.PLACE_OUTLINE        MCAD
TOP          1000.0
0    5080.0  2034.9    0.0
0    5080.0  2645.1  -152.9
0    5080.0  4837.3    0.0
0    4855.3  5042.5    0.0
```

```
0      252.9  5042.5      0.0
0      170.5  4896.9      0.0
0      170.5  4798.4      0.0
0       -5.0  4659.0      0.0
0       -5.0  2645.1      0.0
0       -5.0  2034.9   -152.9
0       -5.0   182.5      0.0
0      192.0    32.5      0.0
0     4883.1    32.5      0.0
0     5080.0   182.5      0.0
0     5080.0  2034.9      0.0
.END_PLACE_OUTLINE
.PLACE_OUTLINE        UNOWNED
BOTTOM          200.0
0      300.0   200.0      0.0
0     4800.0   200.0      0.0
0     4800.0  4800.0      0.0
0      300.0  4800.0      0.0
0      300.0   200.0      0.0
.END_PLACE_OUTLINE
.ROUTE_KEEPOUT          ECAD
ALL
0     2650.0  2350.0      0.0
0     3100.0  2350.0    360.0
.END_ROUTE_KEEPOUT
.PLACE_KEEPOUT          MCAD
BOTH            0.0
0     2650.0  2350.0      0.0
0     3100.0  2350.0    360.0
.END_PLACE_KEEPOUT
.PLACE_KEEPOUT          MCAD
TOP             300.0
0     3700.0  5000.0      0.0
0     3700.0  4300.0      0.0
0     4000.0  4300.0      0.0
0     4000.0  3700.0      0.0
0     5000.0  3700.0      0.0
0     5000.0  4800.0      0.0
0     4800.0  5000.0      0.0
0     3700.0  5000.0      0.0
.END_PLACE_KEEPOUT
.DRILLED_HOLES
     30.0  1800.0   100.0      PTH      J1      PIN      ECAD
     30.0  1700.0   100.0      PTH      J1      PIN      ECAD
     30.0  1600.0   100.0      PTH      J1      PIN      ECAD
     30.0  1500.0   100.0      PTH      J1      PIN      ECAD
     30.0  1400.0   100.0      PTH      J1      PIN      ECAD
     30.0  1300.0   100.0      PTH      J1      PIN      ECAD
     30.0  1200.0   100.0      PTH      J1      PIN      ECAD
     30.0  1100.0   100.0      PTH      J1      PIN      ECAD
     30.0  1000.0   100.0      PTH      J1      PIN      ECAD
     30.0  0900.0   100.0      PTH      J1      PIN      ECAD
     30.0  0800.0   100.0      PTH      J1      PIN      ECAD
     30.0  0700.0   100.0      PTH      J1      PIN      ECAD
     30.0  0700.0   200.0      PTH      J1      PIN      ECAD
     30.0  0800.0   200.0      PTH      J1      PIN      ECAD
     30.0  0900.0   200.0      PTH      J1      PIN      ECAD
     30.0  1000.0   200.0      PTH      J1      PIN      ECAD
     30.0  1100.0   200.0      PTH      J1      PIN      ECAD
     30.0  1200.0   200.0      PTH      J1      PIN      ECAD
     30.0  1300.0   200.0      PTH      J1      PIN      ECAD
     30.0  1400.0   200.0      PTH      J1      PIN      ECAD
```

```
30.0   1500.0    200.0     PTH    J1      PIN    ECAD
30.0   1600.0    200.0     PTH    J1      PIN    ECAD
30.0   1700.0    200.0     PTH    J1      PIN    ECAD
30.0   1800.0    200.0     PTH    J1      PIN    ECAD
30.0   4400.0    100.0     PTH    J2      PIN    ECAD
30.0   4300.0    100.0     PTH    J2      PIN    ECAD
30.0   4200.0    100.0     PTH    J2      PIN    ECAD
30.0   4100.0    100.0     PTH    J2      PIN    ECAD
30.0   4000.0    100.0     PTH    J2      PIN    ECAD
30.0   3900.0    100.0     PTH    J2      PIN    ECAD
30.0   3800.0    100.0     PTH    J2      PIN    ECAD
30.0   3700.0    100.0     PTH    J2      PIN    ECAD
30.0   3600.0    100.0     PTH    J2      PIN    ECAD
30.0   3500.0    100.0     PTH    J2      PIN    ECAD
30.0   3400.0    100.0     PTH    J2      PIN    ECAD
30.0   3300.0    100.0     PTH    J2      PIN    ECAD
30.0   3300.0    200.0     PTH    J2      PIN    ECAD
30.0   3400.0    200.0     PTH    J2      PIN    ECAD
30.0   3500.0    200.0     PTH    J2      PIN    ECAD
30.0   3600.0    200.0     PTH    J2      PIN    ECAD
30.0   3700.0    200.0     PTH    J2      PIN    ECAD
30.0   3800.0    200.0     PTH    J2      PIN    ECAD
30.0   3900.0    200.0     PTH    J2      PIN    ECAD
30.0   4000.0    200.0     PTH    J2      PIN    ECAD
30.0   4100.0    200.0     PTH    J2      PIN    ECAD
30.0   4200.0    200.0     PTH    J2      PIN    ECAD
30.0   4300.0    200.0     PTH    J2      PIN    ECAD
30.0   4400.0    200.0     PTH    J2      PIN    ECAD
30.0   3000.0   3300.0     PTH    U3      PIN    ECAD
30.0   3024.2   3203.0     PTH    U3      PIN    ECAD
30.0   3048.4   3105.9     PTH    U3      PIN    ECAD
30.0   3072.6   3008.9     PTH    U3      PIN    ECAD
30.0   3096.8   2911.9     PTH    U3      PIN    ECAD
30.0   3121.0   2814.9     PTH    U3      PIN    ECAD
30.0   3145.2   2717.8     PTH    U3      PIN    ECAD
30.0   3436.2   2790.4     PTH    U3      PIN    ECAD
30.0   3412.1   2887.4     PTH    U3      PIN    ECAD
30.0   3387.9   2984.5     PTH    U3      PIN    ECAD
30.0   3363.7   3081.5     PTH    U3      PIN    ECAD
30.0   3339.5   3178.5     PTH    U3      PIN    ECAD
30.0   3315.3   3275.6     PTH    U3      PIN    ECAD
30.0   3291.1   3372.6     PTH    U3      PIN    ECAD
30.0   2200.0   2500.0     PTH    U4      PIN    ECAD
30.0   2100.0   2500.0     PTH    U4      PIN    ECAD
30.0   2000.0   2500.0     PTH    U4      PIN    ECAD
30.0   1900.0   2500.0     PTH    U4      PIN    ECAD
30.0   1800.0   2500.0     PTH    U4      PIN    ECAD
30.0   1700.0   2500.0     PTH    U4      PIN    ECAD
30.0   1600.0   2500.0     PTH    U4      PIN    ECAD
30.0   1600.0   2200.0     PTH    U4      PIN    ECAD
30.0   1700.0   2200.0     PTH    U4      PIN    ECAD
30.0   1800.0   2200.0     PTH    U4      PIN    ECAD
30.0   1900.0   2200.0     PTH    U4      PIN    ECAD
30.0   2000.0   2200.0     PTH    U4      PIN    ECAD
30.0   2100.0   2200.0     PTH    U4      PIN    ECAD
30.0   2200.0   2200.0     PTH    U4      PIN    ECAD
20.0   2500.0   3100.0     PTH    BOARD   VIA    ECAD
20.0   2500.0   3200.0     PTH    BOARD   VIA    ECAD
20.0   2500.0   3300.0     PTH    BOARD   VIA    ECAD
20.0   2000.0   1600.0     PTH    BOARD   VIA    ECAD
20.0   1100.0   0900.0     PTH    BOARD   VIA    ECAD
20.0   1200.0   1600.0     PTH    BOARD   VIA    ECAD
```

```
      20.0   3900.0   3800.0      PTH    BOARD      VIA     ECAD
      20.0   3900.0   2300.0      PTH    BOARD      VIA     ECAD
     100.0   3100.0    -50.0     NPTH       J2      MTG     ECAD
     100.0   4600.0    -50.0     NPTH       J2      MTG     ECAD
     100.0    500.0    -50.0     NPTH       J1      MTG     ECAD
     100.0   2000.0    -50.0     NPTH       J1      MTG     ECAD
      93.0   5075.0      0.0      PTH    BOARD      MTG  UNOWNED
      93.0      0.0   4800.0     NPTH    BOARD     TOOL     MCAD
      93.0      0.0      0.0      PTH    BOARD      MTG  UNOWNED
   .END_DRILLED_HOLES
   .NOTES
    3500.0   3300.0     75.0   2500.0   "This component rotated 14 degrees"
     400.0   4400.0     75.0   3200.0   "Component height limited by enclosure latch"
    1800.0    300.0     75.0   1700.0   "Do not move connectors!"
   .END_NOTES
   .PLACEMENT
          cs13_a         pn-cap              C1
    4000.0   1000.0    100.0      0.0      TOP    PLACED
          cc1210        pn-cc1210            C2
    3000.0   3500.0      0.0      0.0      TOP    PLACED
          cc1210        pn-cc1210            C3
    3200.0   1800.0      0.0      0.0   BOTTOM    PLACED
          cc1210        pn-cc1210            C4
    1400.0   2300.0      0.0    270.0      TOP    PLACED
          cc1210        pn-cc1210            C5
    1799.5   3518.1      0.0      0.0   BOTTOM    PLACED
       conn_din24       connector           J1
    1800.0    100.0      0.0      0.0      TOP      MCAD
       conn_din24       connector           J2
    4400.0    100.0      0.0      0.0      TOP      MCAD
         plcc_20 pn-pal16l8-plcc            U1
    1800.0   3200.0      0.0      0.0   BOTTOM      ECAD
         plcc_20 pn-pal16l8-plcc            U2
    3200.0   1800.0      0.0      0.0      TOP    PLACED
         dip_14w     pn-hs346-dip           U3
    3000.0   3300.0      0.0     14.0      TOP    PLACED
         dip_14w     pn-hs346-dip           U4
    2200.0   2500.0      0.0    270.0      TOP    PLACED
   .END_PLACEMENT
```

7.0   Library File Example

```
.HEADER
LIBRARY_file  3.0   "Sample File Generator"  10/22/96.16:41:37  1
.END_HEADER
.ELECTRICAL
        cs13_a          pn-cap    THOU    150.0
0    -55.0    55.0     0.0
0    -55.0   -55.0     0.0
0    135.0   -55.0     0.0
0    135.0   -80.0     0.0
0    565.0   -80.0     0.0
0    565.0   -55.0     0.0
0    755.0   -55.0     0.0
0    755.0    55.0     0.0
0    565.0    55.0     0.0
0    565.0    80.0     0.0
0    135.0    80.0     0.0
0    135.0    55.0     0.0
0    -55.0    55.0     0.0
PROP CAPACITANCE   100.0
PROP   TOLERANCE      5.0
.END_ELECTRICAL
.ELECTRICAL
        cc1210       pn-cc1210    THOU    67.0
0    -40.0    56.0     0.0
0    -40.0   -56.0     0.0
0    182.0   -56.0     0.0
0    182.0    56.0     0.0
0    -40.0    56.0     0.0
PROP CAPACITANCE      0.1
PROP   TOLERANCE      5.0
.END_ELECTRICAL
.ELECTRICAL
      conn_din24       connector  THOU    435.0
0   -1400.0  -500.0    0.0
0     300.0  -500.0    0.0
0     300.0   150.0    0.0
0   -1400.0   150.0    0.0
0   -1400.0  -500.0    0.0
.END_ELECTRICAL
.ELECTRICAL
        dip_14w    pn-hs346-dip   THOU    200.0
0     350.0    50.0    0.0
0     -50.0    50.0    0.0
0     -50.0  -650.0    0.0
0     350.0  -650.0    0.0
0     350.0    50.0    0.0
.END_ELECTRICAL
.ELECTRICAL
        plcc_20 pn-pal16l8-plcc   THOU    14.0
0    -200.0   240.0    0.0
0    -240.0   200.0    0.0
0    -240.0  -240.0    0.0
0     240.0  -240.0    0.0
0     240.0   240.0    0.0
0    -200.0   240.0    0.0
.END_ELECTRICAL
```