Parts Library ASCII File Format Specification PowerPCB 4.0 and PowerLogic 4.0

Innoveda, Inc., reserves the right to modify this specification as necessary in the conduct of its business.

Contents

Introduction

This specification defines the structure and syntax of the Parts Library ASCII export files.

The Parts Library ASCII file format provides a way for other CAD or CAE systems to import and export part and decal information to and from the PowerPCB Parts Library. Using Parts Library ASCII format a user can access library information without accessing the internal databases or source code.

You can convert an entire library, including, part types, part decal descriptions, attributes and graphics into an ASCII file.

Format Conventions

The format of the ASCII file is important for correct interpretation by the Library Manager software. Use the conventions below when creating or modifying a parts library ASCII file:

- Text shown in bold and uppercase within this specification represents keywords and should appear in the ASCII file as it appears in the format statements. For example: ***SIGNAL***

- Uppercase text not in bold represents variables. Definitions for variables and allowed ranges of values are given.

- The variable, NAME, represents an arbitrary alphanumeric text entry of a defined number of characters. Alphanumeric characters include all uppercase and lowercase letters, all numbers, and the special characters:
  `~#$%^&()_-+=;'"[]?/<>!

- Except for general attributes where uppercase and lowercase characters are both accepted, all other data in the file should be uppercase only.

- All rotations are given in positive fixed-point values, from 0 to 359.999 degrees. The finest precision recognized for rotations is 0.001 degree.

- Optional data is enclosed in brackets ([ ]).

Note: Including some optional data can make other optional data required.

- All line entries require a final carriage return (press Enter). This is not explicitly specified in the format definitions.

- Spaces in actual data entries are represented in the format of ASCII statements with an underscore (_).

- All size and coordinate data is in units of mils (0.001 inch) or millimeters depending on the units type (Imperial or Metric) of the item being defined. The finest precision recognized for Imperial units is 0.00001 inch or 0.01 mil. The finest precision recognized for metric units is 0.00001 mm.

Structure of the ASCII File

The Parts Library ASCII file has a different format for each of the four data types that can be exported or imported to and from a Library data type, unlike ASCII-format for PowerLogic and PowerPCB. Each file is dedicated to one data type and contains one or more records. The following four data types are available:

- Drafting Item
- Schematic Decal
- PCB Decal
- Part Type

Each file has a header line to specify the type of file, item type, and version number, followed by the item records and an end of file statement.

Control Statements

All control statements begin and end with an asterisk (*).

PADS-LIBRARY-LINE-ITEMS-V4	Start of Drafting Items file.
PADS-LIBRARY-SCH-DECALS-V4	Start of Schematic Decals file.
PADS-LIBRARY-PCB-DECALS-V4	Start of PCB Decals file.
PADS-LIBRARY-PART-TYPES-V4	Start of Part Types file.
END	End of file.

Start of File

The start-of-file control statement identifies the data that follows it as library ASCII data of the specified type. The start-of-file control statement must be included at the beginning of every library ASCII data file.

The following list shows the start-of-file control statement required for each type of file:

File Type	Control Statement
Drafting Items	***PADS-LIBRARY-LINE-ITEMS-V4***
Schematic Decals	***PADS-LIBRARY-SCH-DECALS-V4***
PCB Decals	***PADS-LIBRARY-PCB-DECALS-V4***
Part Types	***PADS-LIBRARY-PART-TYPES-V4***

End-of-File

The end-of-file statement is required at the end of a library ASCII file.

The control statement for the end-of-file command is:

```
*END*
```

Drafting Item Definition

A drafting item can be a 2D Line for use in PowerLogic or any of the following for use in PowerPCB: 2D Line, Board Outline, Copper Shape, or Keepout.

Drafting Item Format

Each drafting item consists of the following parts:

- Drafting item header line
- Drafting item pieces where each piece consists of:
    - Piece header line
    - Piece corner coordinates
    - …
- Text item (optional, if the drafting item has been combined with text)
- …

Drafting Item Header Format

The drafting item header line consists of:

```
NAME_LINETYPE_U_X_Y_PIECES_TEXT
```

Where:

NAME	User-defined drafting item name
	Values can be up to 40 alphanumeric characters, no spaces.
LINETYPE	Type of item. The following types are allowed: **LINES, BOARD, COPPER, KEEPOUT**
U	Coordinate units type
	Can be either Imperial (mils) or Metric (mm), expressed as a single letter: **I** or **M**.
X_Y	Coordinates of the origin of the item relative to the system origin.
PIECES	Number of pieces that make up the line item. Values range from 1 to 16,777,216 for use in PowerPCB or from 1 to 4,096 for use in PowerLogic.
TEXT	Number of text lines associated with the line item. Values range from 0 to 32,767.

Piece Entry Format

Each piece entry consists of a header line followed by a list of line segment or arc segment coordinates:

```
TYPE_NUMCOORD_WIDTH_LAYER_LINESTYLE
X_Y (format for line segment)
X_Y_AB_AA_AX1_AY1_AX2_AY2 (format for arcs)
```

Where:

TYPE	Type of piece
	Valid values are **OPEN**, **CLOSED**, **CIRCLE**, **COPOPN**, **COPCLS**, **COPCIR**, **BRDCUT**, **BRDCCO**, **KPTCLS**, or **KPTCIR**.
NUMCOORD	Number of coordinates defining the item
	For open items, this is the number of corners. For closed line items, it is the number of corners plus one (to return to the starting corner). Circles have two corners that define opposite ends of any diameter.
WIDTH	Line width of all segments in the piece
	Values range from 0 to 0.25 inches, expressed in the selected units of the item.
LAYER	Numeric layer number for use in PowerPCB
	Values range from 0 to 250. A layer value of zero means all layers. The layer number is ignored in PowerLogic.
LINESTYLE	System flag for type of line
	A value of -1 indicates a solid line; a value of 0 indicates a dotted line.

For piece line segments:

X_Y	Coordinates of each successive corner of the line item relative to the first point in the line item. For closed polygons, the first corner will be repeated.

For piece arc segments:

```
X_Y_AB_AA_AX1_AY1_AX2_AY2
```

X,Y	Beginning of arc
AB	Beginning angle of arc in degrees
AA	Number of degrees swept by arc from the start to the end
AX1,AY1	Lower left point of rectangle around circle of arc
AX2,AY2	Upper right point of rectangle around circle of arc
	The points of the rectangle define the circle radius describing the arc and the location of the center point of the circle relative to the origin of the line item.

Text Item Format

Each text entry consists of two lines as follows:

```
X_Y_ROTATION_LAYER_HEIGHT_WIDTH_MIRROR_JUSTIFICATION
TEXTSTRING
```

X_Y	Coordinates of the text string location relative to the origin of the schematic
ROTATION	Orientation of the text in degrees
LAYER	Numeric layer number for use in PowerPCB
	Values range from 0 to 250. A layer value of zero means all layers. The layer number is ignored in PowerLogic.
HEIGHT	Height of text
	Values range from 0.01 to 1.0 inches, expressed in the selected units type.
WIDTH	Width of text in mils
	Values range from 0.001 to 0.050 inches, expressed in the selected units type.
MIRROR	Flag indicating text mirroring in PowerPCB
	0 = not mirrored, 1 = mirrored about the y-axis when viewed with zero orientation.
JUSTIFICATION	Text string justification
	Value is the decimal equivalent of a bit string as follows:
	Bits 0 to 3 encode a four-bit value for horizontal justification with the following values:
	0 = Left justified 1 = Center justified 2 = Right justified
	Bits 4 to 7 encode a four-bit value for vertical justification with the following values:
	0 = Bottom justified 1 = Middle justified 2 = Top justified.
	Allowed values for justification are as follows:
	Bottom left = 0 Bottom center = 1 Bottom right = 2 Middle left = 16 Middle center = 17 Middle right = 18 Top left = 32 Top center = 33 Top right = 34
TEXTSTRING	Text string
	Up to 255 characters, spaces allowed.

Schematic Decal Definition

Schematic decal coordinates are always expressed in mils; there is no metric option.

Schematic Decal Format

A schematic decal consists of the following parts:
- Schematic decal header line
- Attribute label locations
- Piece definitions
- Text definitions
- Terminal definitions

Schematic Decal Header Format

The schematic decal header line consists of:

```
NAME_X_Y_PNHGT_PNWID_PNMHGT_PNMWID_LABELS_PIECES_TXT_TERMINALS_VIS
```

Where:

NAME	User-defined decal name
	Values can be up to 40 alphanumeric characters.
X_Y	Coordinates of the symbol origin
	Expressed in mils.
PNHGT	Height of pin number text
	Values range from 10 to 1000.
PNWID	Line width of pin number text
	Values range from 1 to 50.
PNMHGT	Height of pin name text
	Values range from 10 to 1000.
PNMWID	Line width of pin name text
	Values range from 1 to 50.
LABELS	Number of attribute label locations defined for the decal
PIECES	Total number of drawing pieces that make up the symbol
	Values range from 0 to 4096. A definition follows each piece.
TXT	Number of free text strings within the decal
TERMINALS	Total number of terminals in the symbol that make up each decal
	Values range from 0 to 2048.

VIS	Visibility flag
	Variable value associated with the visibility of part text. The minimum value is 0; the maximum value is 31. These values are determined in bits, and are as follows:

For off-page symbols:
```
BIT 0 = NETNAME INVISIBILITY
```
For connector decals:
```
BIT 0 = REF DES AND PIN NUMBER INVISIBILITY
BIT 1 = PART TYPE INVISIBILITY
```
For part decals:
```
BIT 0 = REF DES INVISIBILITY
BIT 1 = PART TYPE INVISIBILITY
BIT 3 = PIN NAMES INVISIBILITY
BIT 4 = PIN NUMBERS AND NAMES
```

Note: A bit set indicates that the name is *not* visible.

Attribute Labels Format

No matter what type of decal is being defined, there are at least two label definitions:

- Label for the reference designator location
- Label for the part type name location.

The use of the reference designator part type label varies, depending upon the type of decal. For example, an off page reference decal does not have a reference designator. Therefore, some decals might have unused label definitions, but at least two labels must be defined.

Refer to the previous section, Visibility Flag (VIS), where bits 0 and 1 describe which items are displayed in the reference designator and part type labels for each type of decal.

If there are more than two labels, the additional labels are for part or connector attribute values.

```
X_Y_ROTATION_JUSTIFICATION_HEIGHT_WIDTH
TEXTSTRING
```

Where:

X_Y	Coordinates of the text string location relative to the origin of the schematic
ROTATION	Orientation of the text in degrees
JUSTIFICATION	See definition of Justification in "Text Item Format" in the "Drafting Item Definition" section.
HEIGHT	Height of text
	Values range from 10 to 1000 mils.
WIDTH	Width of text in mils
	Values range from 1 to 50 mils.

INNOVEDA.

TEXTSTRING | Name of the attribute whose location is being defined

The first two labels always have attribute names **REF-DES** and **PARTTYPE**. Subsequent labels may have a specific name such as "PART DESCRIPTION" or may have an asterisk (*) indicating that this location can be used for any attribute.

Attribute names can be up to 255 alphanumeric characters long.

Piece Entry Format

The schematic decal piece format is identical to the "Drafting Item Format" with the following differences:

- All coordinate values are expressed in mils
- The piece type field TYPE can only have the values OPEN, CLOSED, CIRCLE, and COPCLS.

Terminal Format

Each terminal is described in two lines:

```
TX_Y_RTN_XYM_PNX_PNY_PNRTN_PNJUST_PNMX_PNMY_PNMRTN_PNMJUST_PINDECAL
PPLX_PLY_PLRTN_PLJUST_NLX_NLY_NLRTN_NLJUST_PFLAGS
```

Where:

A terminal definition line starts with the letter "**T**" and the second line starts with the letter "**P**".

X_Y | Coordinates of the terminal location relative to the decal origin

RTN | Terminal rotation in degrees
Value is 0 or 90.

XYM | Terminal mirror flags
Values are:

> 0 = no mirror
> 1 = X mirror
> 2 = Y mirror
> 3 = X and Y mirror

PNX PNY | X_Y location of the pin number relative to the terminal

PNRTN | Pin number rotation in degrees
Valid value is 0 or 90.

PNJUST | Pin number justification
See JUSTIFICATION definition for Free Text items.

PNMX PNMY | X_Y location of the pin name relative to the terminal

PNMRTN | Pin name rotation in degrees
Valid value is 0 or 90.

PNMJUST | Pin name justification
See JUSTIFICATION definition for Free Text items.

PINDECAL	Name of the pin decal
PLX PLY	X_Y location of the pin properties label relative to the terminal
PLRTN	Pin properties label rotation in degrees
	Valid value is 0 or 90.
PLJUST	Pin properties label justification
	See JUSTIFICATION definition for Free Text items.
NLX NLY	X_Y location of the netname label relative to the terminal
NLRTN	Netname label rotation in degrees
	Valid value is 0 or 90.
NLJUST	Netname label justification
	See JUSTIFICATION definition for Free Text items.
PFLAGS	Defines whether the pin properties or netname label positions are valid for this terminal. If not valid, the positions are taken from the corresponding label positions in the pin decal associated with the terminal.

A clear flag indicates the label is valid, a set flag indicates the label position in the terminal is to be ignored. The flags are:

Bit 6   Pin properties label position invalid
Bit 7   Netname label position invalid

PCB Decal Definition

PCB Decal Format

A PCB decal consists of the following parts:

- Header line
- Decal attributes
- Attribute label locations
- Piece definitions
- Text definitions
- Terminal definitions
- Pad-stack definitions

PCB Decal Header Format

The PCB decal header line consists of:

```
NAME_U_X_Y_ATTRS_LABELS_PIECES_TXT_TERMINALS_STACKS
```

Where:

NAME	User-defined decal name
	Values can be up to 40 alphanumeric characters.
U	Coordinate units type
	Can be either Imperial (mils) or Metric (mm), expressed as a single letter: **I** or **M**.
X_Y	Coordinates of the symbol origin
	Expressed in mils.
ATTRS	Number of attributes defined for the decal.
LABELS	Number of attribute label locations defined for the decal.
PIECES	Total number of drawing pieces that make up the symbol
	Values range from 0 to 16,777,216. A definition follows each piece.
TXT	Number of free text strings within the decal.
TERMINALS	Total number of terminals in the symbol that make up each decal
	Values range from 0 to 32,767.
STACKS	Number of different pad stack definitions available to share between the terminals.

Attribute Format

The attributes format is a list of name-value pairs in the following format:

```
"ATTRNAME"_ATTRVAL
```

Where:

ATTRNAME	Attribute name
	Text string from 1 to 255 characters (uppercase or lowercase) enclosed in quotation marks because it may contain embedded spaces.
ATTRVAL	Attribute value
	Text string from 0 to 2,047 characters terminated by the end of the line.

Attribute Labels Format

Each attribute label consists of two lines as follows:

```
X_Y_ROTATION_MIRROR_HEIGHT_WIDTH_LAYER_JUSTIFICATION_FLAGS
TEXTSTRING
```

X_Y	Coordinates of the text string location relative to the origin of the schematic
ROTATION	Orientation of the text in degrees
MIRROR	Flag indicating text mirroring in PowerPCB
	0 = not mirrored, 1 = mirrored about the y-axis when viewed with zero orientation.
HEIGHT	Height of text
	Values range from 0.01 to 1.0 inches, expressed in the selected units type.
WIDTH	Width of text in mils
	Values range from 0.001 to 0.050 inches, expressed in the selected units type.
LAYER	Numeric layer number for use in PowerPCB
	Values range from 0 to 250. A layer value of zero means all layers.
JUSTIFICATION	See definition of Justification in "Text Item Format" in the "Drafting Item Definition" section.

FLAGS	Type of label, name/value visibility, and right reading status
	Values are the decimal equivalent of an eight-bit binary value with bit fields defined as follows:
	Bits 0 to 2 contain a numeric value to define the label type:
	0 = General attribute label
	1 = Reference designator
	2 = Part type
	Bit 3 set indicates the label is right reading and displayed at the nearest 90-degree orientation.
	Bit 4 set indicates label is right reading but display is not constrained to a 90-degree orientation.
	Bit 5 set indicates that the attribute value is displayed.
	Bit 6 set indicates that the short version of the attribute name is displayed.
	Bit 7 set indicates that the full structured attribute name is displayed.
TEXTSTRING	Name of the attribute whose location is being defined
	The reserved names "REF-DES" and "PARTTYPE" refer to reference designator and part type labels
	Up to 255 characters, spaces allowed.

Piece Definition Format

The PCB decal piece format is identical to the "Drafting Item Format" in this document, with the following differences:

PIECETYPE cannot have the values **BRDCUT** or **BRDCCO**.

PIECETYPE can have additional values **COPCUT**, **COPCCO**.

Terminal Format

```
TX1_Y1_X2_Y2
```

A terminal definition line starts with the letter "**T**".

Where:

X1_Y1	Location of the terminal relative to the decal origin
X2_Y2	Location of the terminal pin number label relative to the decal origin.

Pad Stack Format

Each pad stack definition consists of a header line followed by a line for each pad stack layer.

Header line:

```
PAD_PIN_NUMLAYERS_PLATED_DRILL_[DRLORI_DRLLEN_DRLOFF]
```

Each layer line can have one of the following formats:

```
LAYER_WIDTH_SHAPE
```
   (Round and square normal or anti-pads)
```
LAYER_WIDTH_SHAPE_INTD
```
   (Annular pads)
```
LAYER_WIDTH_SHAPE_ORI_LENGTH_OFFSET
```
   (Oval and rectangular pads)
```
LAYER_WIDTH_SHAPE_ORI_INTD_SPKWID_NUMSPK
```
   (Thermal pads)

PAD	Keyword
PIN	Pin number to which the pad stack applies
	If the pin number is zero, then the pad stack applies to all pins that do not have a specific pad stack.
NUMLAYERS	Number of pad stack layer lines that follow the header line.
PLATED	Either the keyword **P** for plated drill hole or **N** for nonplated drill hole.
DRILL	Drill diameter for the pad
	Value of zero indicates that there is no drill hole.
DRLORI	Orientation of a slotted hole
	Valid values range from 0 to 179.999 degrees.
DRLLEN	Slotted hole length
DRLOFF	Slot offset
LAYER	Layer number
	Valid values range from 1 to 250.
	or
	Layer code of the pin
	Layer codes are defined as follows:
	-2 is the top layer
	-1 is all inner layers
	-0 is the bottom layer
WIDTH	Width of a finger pad or the external diameter of all other pad shapes
SHAPE	Shape can be one of the following values:
	R round pad
	S square pad
	RA round anti-pad
	SA square anti-pad
	A annular pad
	OF oval finger pad

	RF rectangular finger pad
	RT round thermal pad
	ST square thermal pad
INTD	Internal diameter of an annular or thermal pad
ORI	Orientation of a finger pad or the thermal spokes
	Valid values range from 0 to 179.999 degrees.
LENGTH	Finger pad length
OFFSET	Finger pad offset
SPKWID	Thermal pad spoke width
NUMSPK	Number of thermal pad spokes

Part Type Definition

Part Type Format

Each part type entry consists of the following parts:

- Part type header line
- Attribute information (optional)
- Gate information (optional)
- Signal pin information (optional)
- Alphanumeric pins (optional)

Part Type Header Format

The part type header line consists of:

```
NAME_PCBDECALS_U_TYPE_ATTRS_GATES_SIGNALS_ALPINNM_FLAG_CPIN
```

Where:

NAME	Part type name
	Values can be up to 40 alphanumeric characters.
PCBDECALS	List of alternate PCB decal names, separated by colons NAME**:**NAME**:**…
	A PCB decal name can be up to 40 alphanumeric characters. The list may have a maximum of 16 alternates.
U	Coordinate units type
	Can be either Imperial (mils) or Metric (mm), expressed as a single letter: **I** or **M**.
TYPE	Logic type
	Values can be any three alphanumeric characters.
GATES	Number of gates in the part
	Values range from 0 to 702.
SIGNALS	Number of standard signals predefined in the part, which is typically, but not exclusively, power and ground.
	Values range from 0 to 1,024.
ALPINNM	Number of alphanumeric pins defined in the part
	Values range from 0 to 32,767.
FLAG	Decimal value of an eight-bit binary bit string:
	Bits 0–1 taken as a two-bit number define the type of part:
	0 = normal part
	1 = connector
	2 = off-page reference.
	Bit 2 is a flag that is set for a non-ECO registered part type.
	Bit 7 is a flag that is set to indicate an incomplete or inconsistent part type.

CPIN	Number of connector pins
	If the part is defined as a connector, values range from 1 to 32,767. If the part is *not* defined as a connector, the value is not defined and is usually zero.

Attribute Format

The attributes format is a list of name-value pairs in the following format:

```
"ATTRNAME"_ATTRVAL
```

Where:

ATTRNAME	Attribute name
	Text string from 1 to 255 characters (uppercase or lowercase) enclosed in quotation marks because it may contain embedded spaces.
ATTRVAL	Attribute value
	Text string from 0 to 2,047 characters terminated by the end of the line.

Gate Format

The gate format consists of two parts:

- Header line, which describes the gate type and amount of pins in the gate.
- The second line is repeated for each pin in the gate, and it describes the actual pins within the gate.

The format is as follows:

```
G:GATEDECALS_GATESWAP_PINS
PINNUMBER.SWPTYP.PINTYP.PINNM
```

Where:

G:	Keyword
GATEDECALS	List of alternate schematic decal names, separated by colons: NAME:NAME:…
	A gate decal may be up to 40 alphanumeric characters. The list may contain a maximum of four alternates.
GATESWAP	Gate swap type
	It is assumed that gates with the same swap type are electrically equivalent. A gate with a swap type of 0 is not swappable.
PINS	Number of pins in the gate
	Valid values range from 0 to 32,767.
PINNUMBER	Electrical pin number of the pin in the gate
	Pin numbers may not be duplicated. Valid values range from 1 to 32,767.

SWPTYP	Swap type of the pin
	It is assumed that pins with the same swap type are electrically equivalent. A pin with a swap type of 0 is not swappable.
PINTYP	Pin electrical type. Values are:

S   source pin
B   bidirectional pin
C   open collector pin
O   or-tieable source pin
T   tristate pin
L   load pin
Z   terminator pin
P   power pin
G   ground pin
U   undefined pin

PINNM	Optional
	Electrical pin name of the pin in the gate
	Pin names may not be duplicated. A pin name can be up to 14 alphanumeric characters. *No* spaces are allowed in a pin name.

Signal Pin Format

This section describes pins for standard signals for parts. Typically, standard signals are power or ground, but any signal name may be used. For each entry, the format is as follows:

```
SIGPIN_PINNO_WIDTH_SIGNM
```

Where:

SIGPIN	Keyword
PINNO	Pin number of the signal pin
	Valid values range from 1 to 32,767.
WIDTH	Width of the track for the connection in the PCB design
	Valid values range from 0 to 0.25 inches.
SIGNM	Name of the standard signal
	Signal names may be up to 47 alphanumeric characters.

Alphanumeric Pin Format

This section defines a pin name for every pin in the part

The format is:

```
N1 _N2 _N3 _...NX
```

Where:

N1, N2 ...	Pin names
	Pin names may be up to seven alphanumeric characters.
	There is a one-to-one correspondence between pin numbers and pin names. The order is from pin 1 to the last pin. If pin names are used, all pins must be defined.