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*Library User Guide*

*PADS\_Net\_List\_Library*

*Rev 1a*

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## Introduction and Setup

Welcome to the Optimum Design Associates PADS\_Net\_List\_Library. This library package contains the modules that are required for the successful netlist flow integration between DxDesigner / DxDatabook schematic entry and PADS Layout PCB Design. It is designed for use with the following software:

- Mentor Graphics – **DxDesigner version Flow ID: PADS 9.5**
- Mentor Graphics – **PADS Layout version 9.5**
- Microsoft® – **Access® 2007, 2010 and 2013**

## Library Definition

Throughout the documentation, references are made to the following “Library” packages:

- **PADS\_Net\_List\_Library**
- **DxDatabook Libraries**
- **PADS Library**

To avoid any confusion about the use of the word “Library,” a brief description of each one is outlined below.

**PADS\_Net\_List\_Library** – The total package supplied by OPTIMUM, consisting of:

- DxDatabook configuration
- Microsoft Access Database
- PADS Libraries – PADS Part Types and Footprint Decals
- DxDesigner Schematic Symbols

**DxDatabook Libraries** – Are linked to the various Access database tables. They are able to be searched for parts to include in schematic entry.

**PADS Libraries** – Contains the decals and Part Types in the folder **PADS\_Net\_List\_Library\PADS\_Libraries\**.

## Library Folder Structure

The basic folder structure of the Library is as follows:

**PADS\_Net\_List\_Library\** – is the top level folder of the library structure which contains the folders  
DxDatabookData  
Schematic\_Symbols.  
PADS\_Libraries

### DxDesigner related library files:

**DxDatabookData \ Databook.mdb** – is the Access database containing part information.

**DxDatabookData \ PADS\_Net\_List.dbc** – is the DxDatabook configuration file.

**Schematic\_Symbols \ folders** – contain the DxDesigner schematic symbols.

### PADS PCB related library files.

|                                   |              |                                                             |
|-----------------------------------|--------------|-------------------------------------------------------------|
| <b>PADS_Libraries\</b> contains - | <b>*.pt9</b> | PADS Part Types.                                            |
|                                   | <b>*.pd9</b> | PADS Part Decals (PCB footprints).                          |
|                                   | <b>*.lt9</b> | PADS Line Items.                                            |
|                                   | <b>*.ld9</b> | PADS Logic Decals (CAE symbols) – (not used in DxDesigner). |

## Installation

Use the following procedure to install and configure your PADS\_Net\_List\_Library.

The default directory path for the library is **C:\PADS\_Net\_List\_Library**.

After you unzip the downloaded PADS\_Net\_List\_Library.zip you will need to move the library folder to this location.

“C:” is referred to as **<libpath>** in the instructions below. If you change the default path, then please substitute your designated path below wherever **<libpath>** appears in these instructions.

## Configuration

The aim with the Library, configuration files and documentation is to provide a design flow in its simplest working form, i.e., place parts from DxDatabook onto a DxDesigner schematic and forward annotate into a PADS PCB layout.

There are many other configuration options and settings for various work flows and add-on toolsets. We do not attempt to cover every single aspect of the Mentor DxDesigner to PADS environment with our documentation. Mentor provides an extensive help system, user guides, and web or phone-based support.

## DxDatabook Configuration

Configure your DxDatabook by using the following instructions to create a Windows ODBC Data Source:

1. Create an ODBC Data Source for the DxDatabook you need to run the windows ODBC Data Source Administrator tool as follows:
  - a. Windows XP - **Windows Control Panel \ Administrative Tools \ Data Sources (ODBC)**
  - b. Windows 7 32-Bit -> **Windows Control Panel \ System and Security \ Administrative Tools \ Data Sources (ODBC)**.
  - c. Windows 7 64-Bit -> DxDatabook requires the Data Source to be created in 32-Bit mode. On Windows 64-Bit systems, the ODBC Data Source Administrator must be invoked in 32-Bit mode as follows.
    - i. Browse to **C:\Windows\sysWOW64**
    - ii. Double click the **odbcad32.exe** file ( this is the 32bit version )

**Note:** It is very important that DxDatabook Data Sources for 64-Bit systems are created in this manner (via odbcad32.exe), if they are created via **Administrative Tools** they will look correct but they will not run in DxDatabook.

- d. You should see the following dialog (you won't have the same User Data Sources already listed).

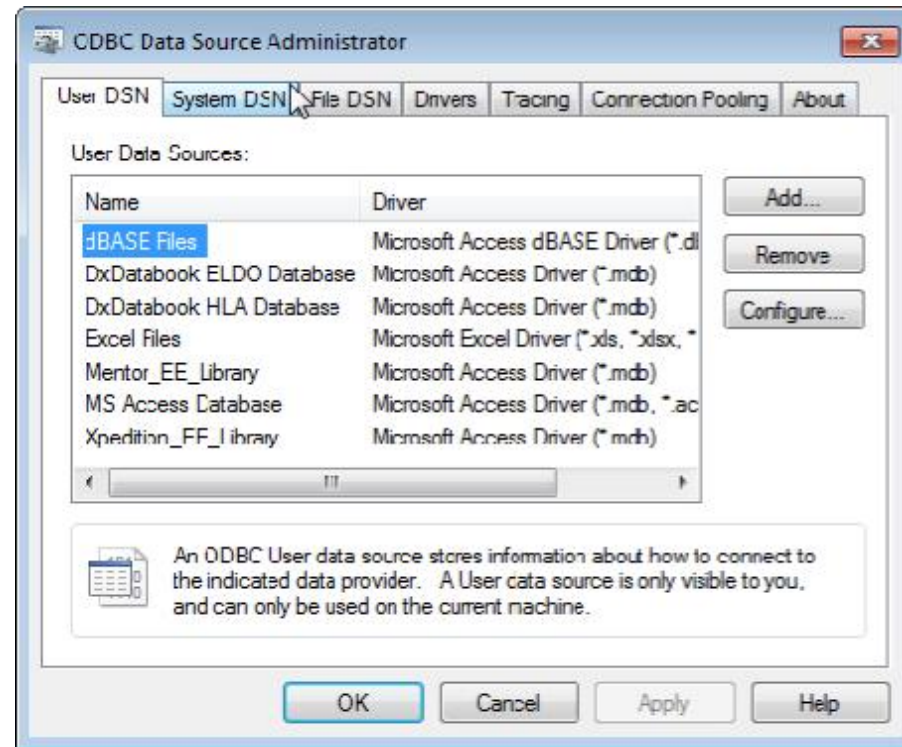


Figure 2.1 ODBC Data Source Administrator

- e. Now click the **Add** button to create your new Data Source, you should see the following screen:

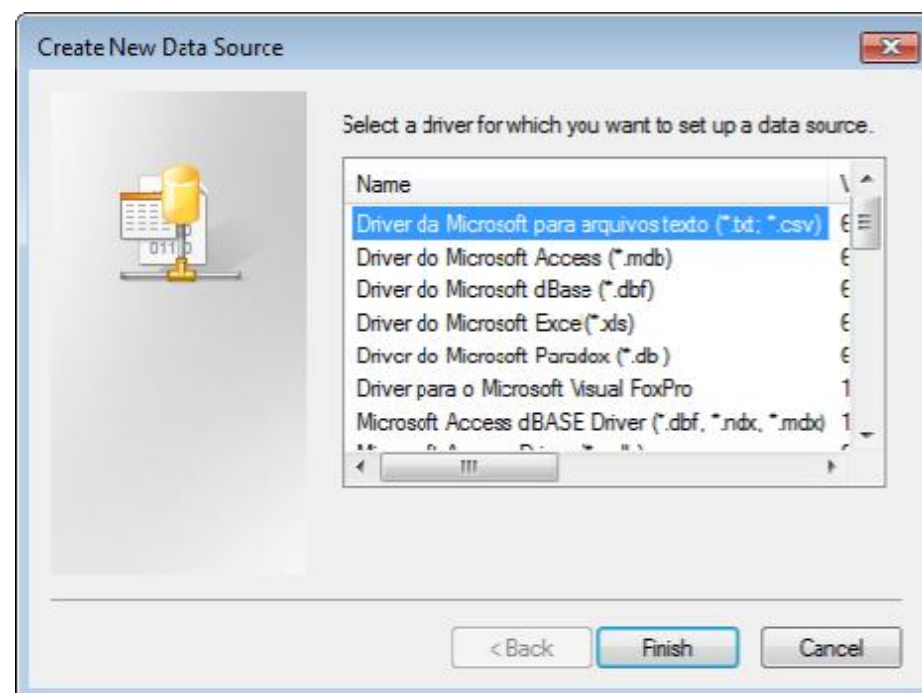


Figure 2.2 Available drivers list Windows XP or Windows 7 – 32bit

- f. Scroll down and select **Microsoft Access Driver (\*.mdb)** as the driver and click the **Finish** button.

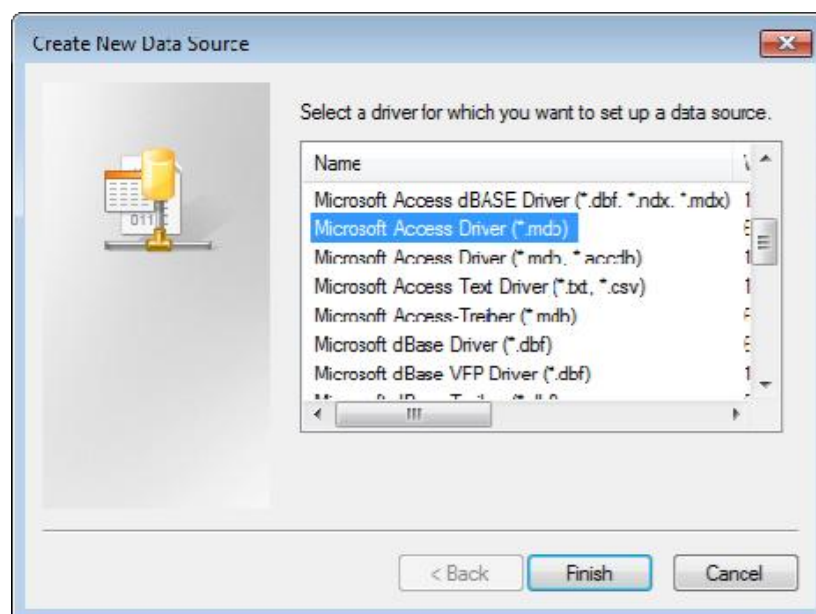


Figure 2.3 Selecting the Microsoft Access (\*.mdb) driver

2. Now you see the ODBC Microsoft Access Setup screen. Enter **PADS\_Net\_List\_Library** as the Data Source Name and optionally a Description of your choice.

Then click on the **Select...** button and browse to and select the file **<libpath>\PADS\_Net\_List\_Library\IdxDatabookData\Databook.mdb** as the database to use for this Data Source.

**Note:** in some cases you may find the system will not allow you to browse for the file outside of the Windows folder. If this happens, start again and Right Click on the **Data Sources (ODBC)** tool in Windows XP or Windows 7 – 32bit, or the **odbcad32.exe** in Windows 7 – 64bit, and select Run as Administrator.

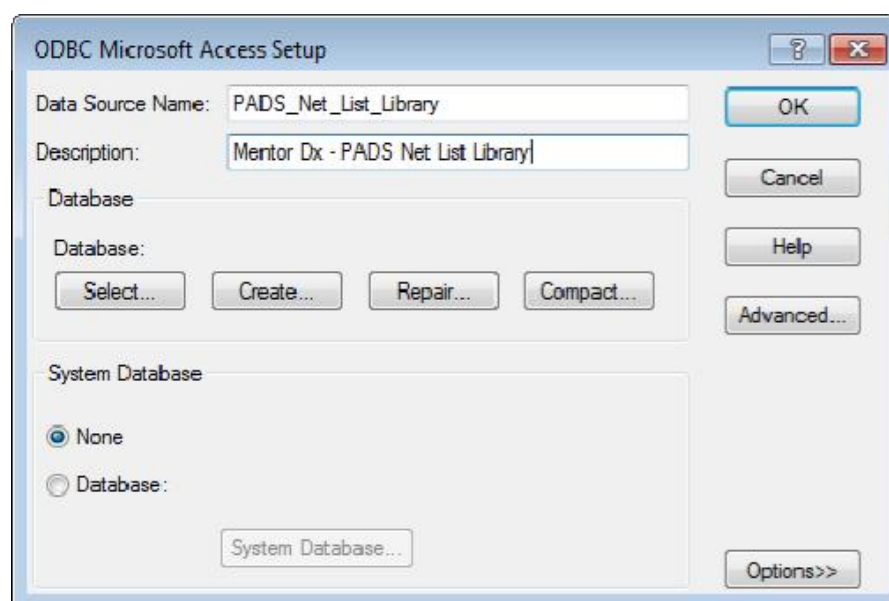


Figure 2.4 Entering the Data Source Name and Description

3. Click **OK** to complete this part and then **OK** again on the **ODBC Data Source Administrator** dialog to complete the Data Source setup procedure.
4. If the location of the library changes, then the Data Source defined above will need to be modified to select the new database location. Other DxDesigner settings will need to be changed as well, see the ReConfiguration section later in this document for detailed information on this.

## Project Template File

A project template file is provided with the library for creating new DxDesigner projects.

- **Mentor\_PADS\_Library\_Seed\_Job.prj**. This is a DxDesigner project file. You can place this file in your **<InstallPath>\SDD\_HOME\standard\templates\dxdesigner\netlist** folder. Where **<InstallPath>** is the location of your MentorGraphics software installation. Once this file is in this location it will appear in the DxDesigner Dashboard or DxDesigner application itself as a template when you create a new project. Selecting this template when you create a new project will create a project with the library association already linked. In DxDesigner select **File > New > Project**

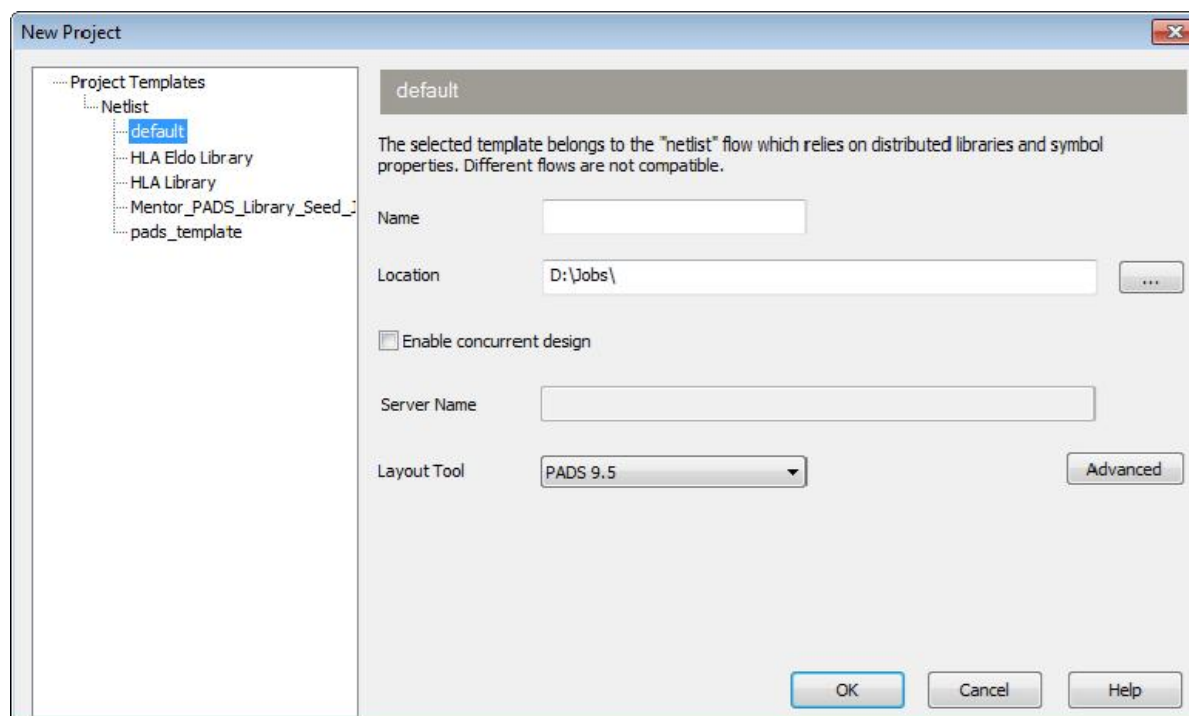


Figure 2.5 DxDesigner New Project Dialog

Select the Mentor\_PADS\_Library\_Seed\_Job template from the list of available templates and enter a project name to create a new DxDesigner project pre linked to the Mentor\_PADS\_Library.

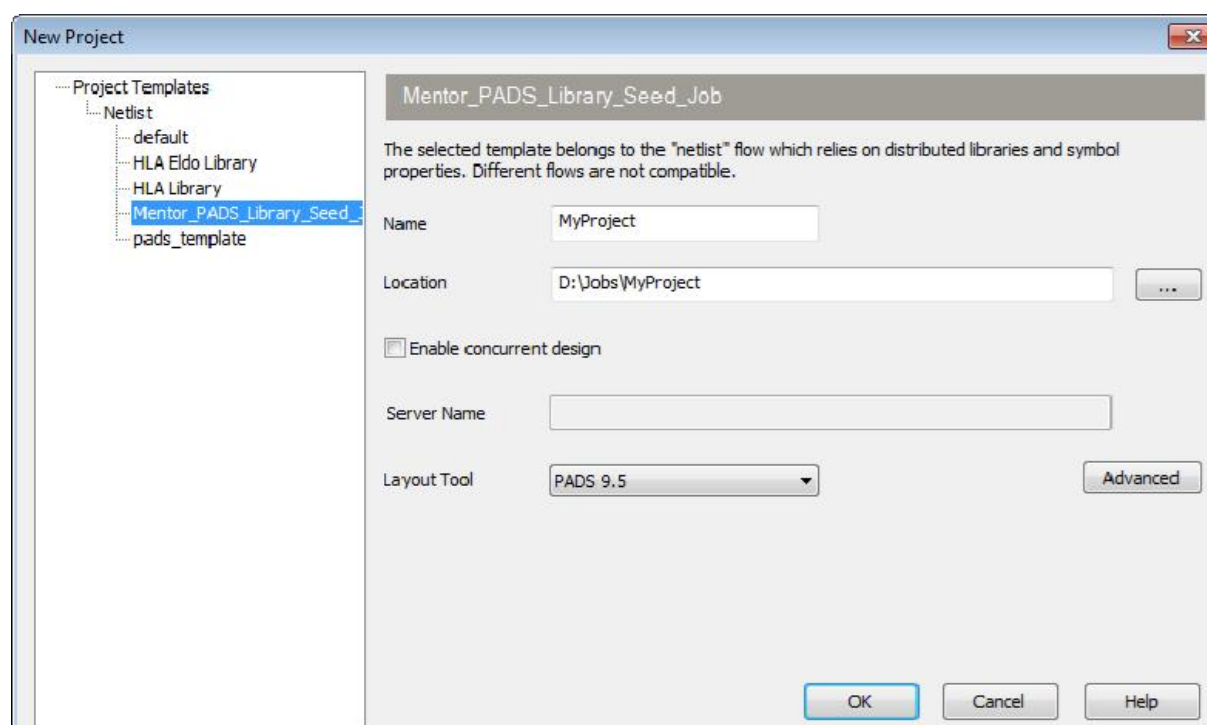


Figure 2.6 Selecting the Mentor\_PADS\_Library\_Seed\_Job project template

## Arial or San Serif Font

The symbols in the library have been designed for use with Arial or San Serif text font. This is an extremely important setting because if it is not configured then all text defined in the schematic symbols will appear too large and out of place. This applies to Reference Designator, Pin Name, Pin Number and some visible properties defined for use on symbols. If you are using the symbol library and are seeing fonts other than Arial or San Serif for these items, then follow these instructions to update your configuration. This is a user setting that is not local to the project, it is saved in the DxDesigner.xml file in your WDIR folder so you should only need to change this once. If your environment requires the use of a stroked font then choose San Serif.

To update the active project use the DxDesigner **Setup > Settings** dialog.

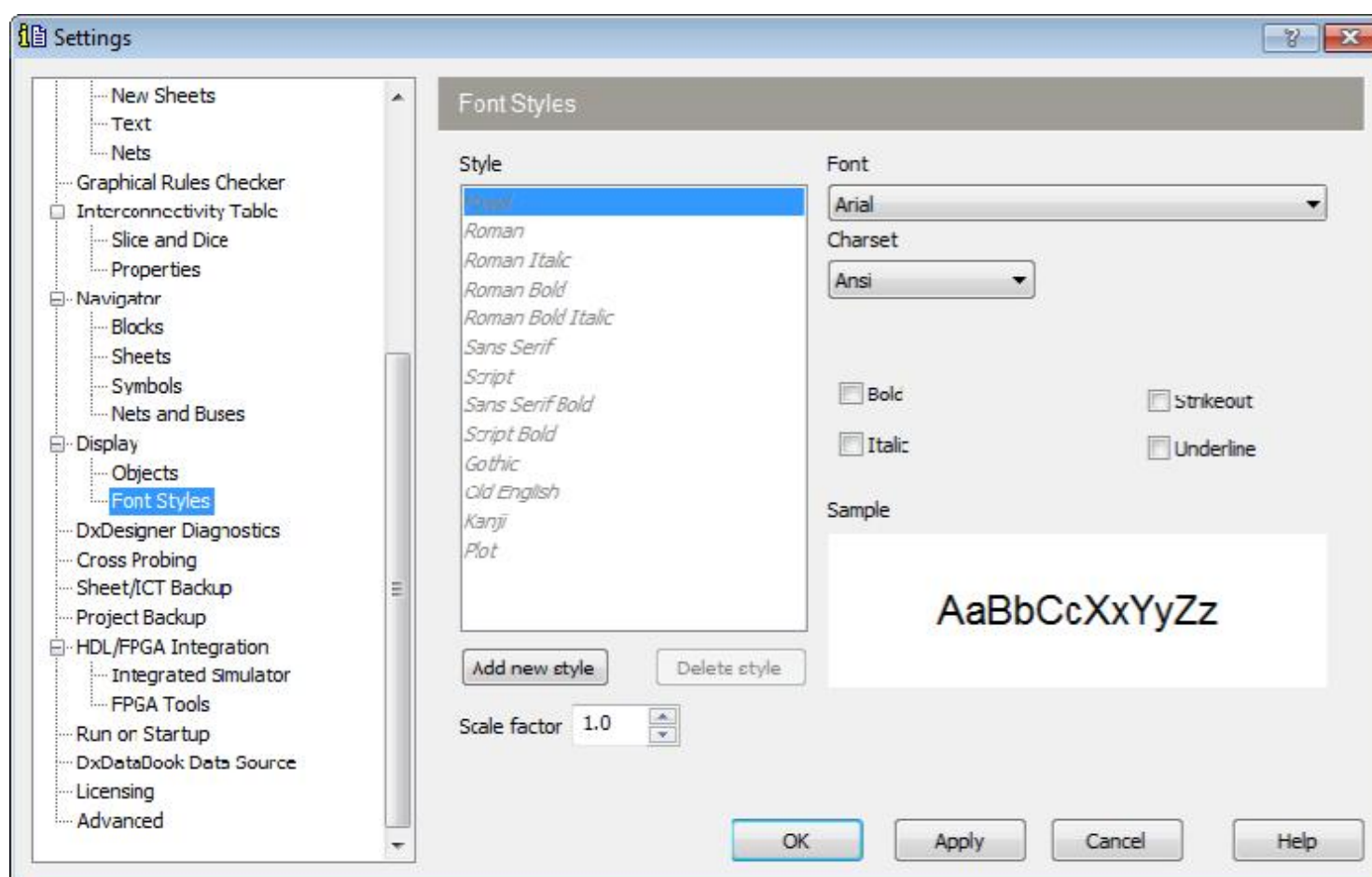


Figure 2.7 Font Settings

## Borders.ini and Speccomp.ini Files

These files determine the source location of Special Components symbols and Border symbols in the DxDesigner environment. The project template that is provided is set up to find these files in the default installation

**C:\PADS\_Net\_List\_Library** folder. If you move the library to a different location then you will need to modify these settings in existing projects and templates if you want to use these files..

## Pads95.cfg File

The PADS\_Net\_List\_Library for DxDesigner makes use of DxDatabook to add all part properties to symbols as they are placed in the schematic. This means there are no **DEVICE** or **PKG\_TYPE** properties defined in the actual DxDesigner symbols. When this is the case you will likely see one of the following errors when you attempt to forward annotate to a PADS PCB:

- **PCB Error 6057** - Bad Attribute Value
- **Error 6035** -Illegal Length 0

This occurs because, by default, the pads95.cfg file setting does not allow for zero length SYMBOL level attributes for **DEVICE** and **PKG\_TYPE**.

This is a known DxDesigner – PADS PCB flow issue and is addressed in Mentor Technote MG29989.

For convenience the workaround is presented below.

You will need to modify your pads95.cfg pcb configuration file, or if you have already customised this file then you need to modify the one you use, to allow for zero length attributes on the symbols for these two properties.

Open your pad95.cfg file (or your own custom .cfg file) in a text editor and locate the following two lines:

```
CHKVAL _NAME_CHK SYMCOM DEVICE ERR 0 "~\{\},.\` \t\n\r@" "" 1 40
CHKVAL _NAME_CHK SYMCOM PKG_TYPE ERR 0 "~\{\},.\` \t\n\r" "" 1 40
```

Edit to create 4 lines as follows:

```
CHKVAL _NAME_CHK SYM DEVICE ERR 0 "~\{\},.\` \t\n\r@" "" 0 40
CHKVAL _NAME_CHK COM DEVICE ERR 0 "~\{\},.\` \t\n\r@" "" 1 40
CHKVAL _NAME_CHK SYM PKG_TYPE ERR 0 "~\{\},.\` \t\n\r" "" 0 40
CHKVAL _NAME_CHK COM PKG_TYPE ERR 0 "~\{\},.\` \t\n\r" "" 1 40
```

Save the file and you are done.

## Netlist.prp File

This file is required to provide the Property Definitions for use in the Dx Designer environment. Properties are defined as System Properties (non editable) or User Added Properties. The Netlist.prp file provided in the library folder defines all of the User Added Properties that are required for use with the PADS\_Net\_List\_Library. It defines things like the valid characters, fonts, colors and property lengths for each property used. This file also enables property checking during the verify, package and forward annotation processes in DxDesigner.

The provided Netlist.prp file should be placed in your install path for PADS in the **SDD\_HOME\standard** folder. If you already have your own customized netlist.prp file then you will need to add the definitions for the following properties from the supplied file to your customized file:

| Property Name       |
|---------------------|
| Capacitance         |
| Component Type      |
| Datasheet           |
| Inductance          |
| RatedVoltage        |
| Manufacturer        |
| ManufacturerLink    |
| ManufacturerPN      |
| Package             |
| Photo               |
| RatedCurrent        |
| RatedPower          |
| Resistance          |
| Status              |
| Supplier            |
| SupplierPN          |
| SupplierLink        |
| SupplierCategory    |
| SupplierSubCategory |

*Figure 2.8 Netlist.prp Property Names*

## Logic Families

There are some Logic Families that need to be added to PADS for parts in the PADS\_Net\_List\_Library. This is done by adding the following lines to the file **<InstallPath>\9.5PADS\SDD\_HOME\Programs\powerpcb.ini**. These lines should be added after the line "LogFam49=ZEN,Z"

```
LogFam50=SPK,SPKR
LogFam51=BAT,BAT
LogFam52=BRD,BR
LogFam53=LED,CR
LogFam54=FLT,FLT
LogFam55=BLT,BLT
LogFam56=DOC,DOC
LogFam57=FH,FH
LogFam58=HS,HS
LogFam59=SPC,SPCR
LogFam60=LBL,LBL
LogFam61=LK,LK
LogFam62=MP,MP
LogFam63=MOD,MOD
LogFam64=MTG,MTG
LogFam65=NUT,NUT
LogFam66=SCW,SCRW
LogFam67=WSH,WSH
LogFam68=TP,TP
```

## Completing the Configuration

The Library Manager in the PADS Layout tool must be set up to enable the use of the Decal and Parts Libraries provided. Instruction on how to do this is outlined in **Library Paths -> Decals and Parts Libraries** in the next section of this document

The installation and configuration are now complete, and everything is in place to enable schematic entry and forward annotation to a PCB layout.

# Library Paths

The seed job that is provided with the library has all the library paths pre-configured. This section outlines where the libraries are referenced. The project file may also be opened in a text editor to have the paths edited if required.

- **Symbol libraries**

The paths to the symbol libraries are setup using the **Setup > Settings** dialog in xDX Designer.

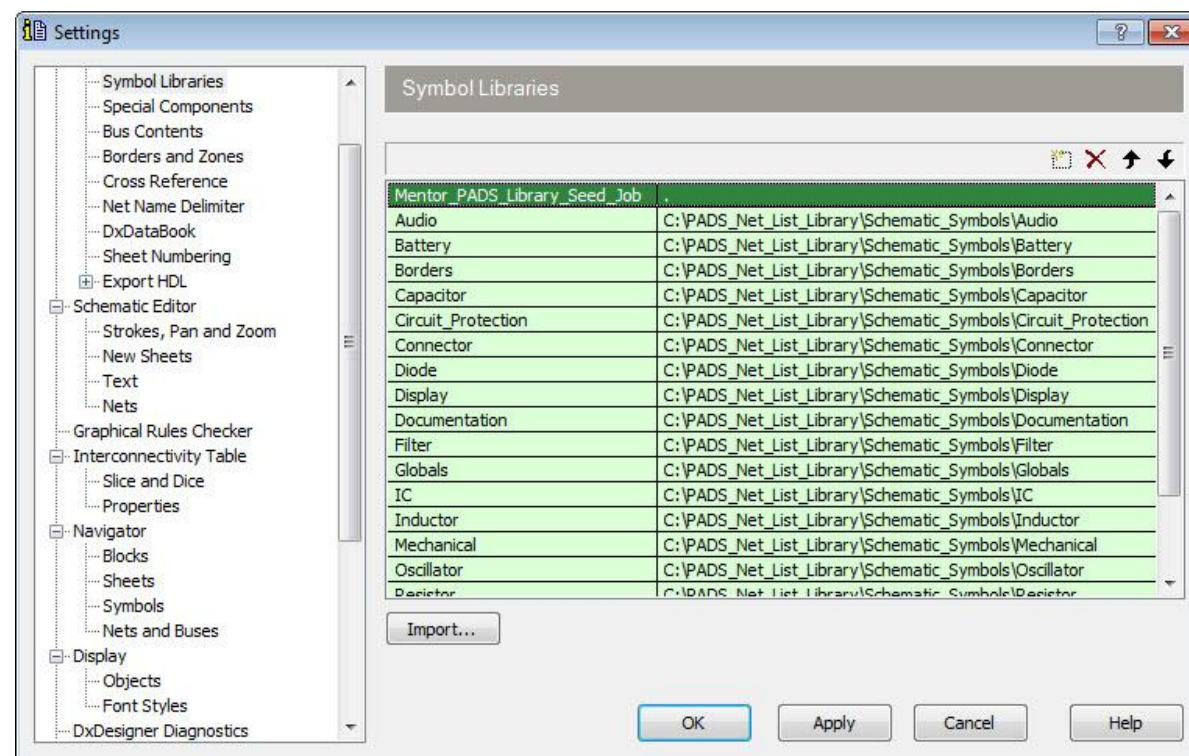


Figure 3.1 Defining Symbol Libraries Locations For Netlist Flow

- **Decals and Parts libraries**

To set up the Part and Decal Libraries in the PADS PCB Editor select **File > Libraries** from the Main Menu. This will open the **Library Manager** dialog as follows:

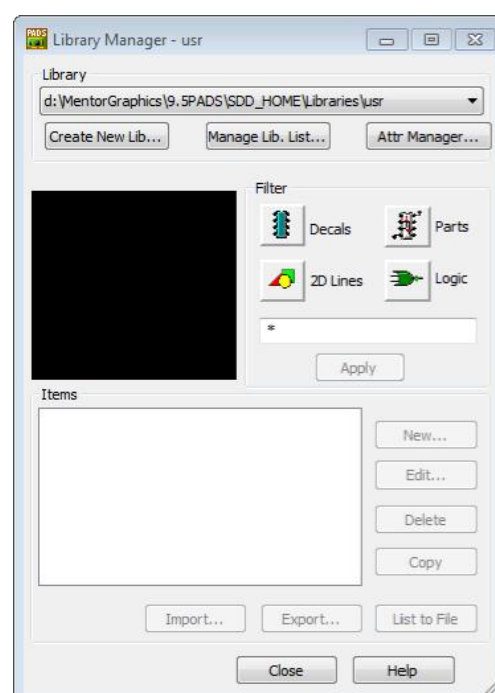


Figure 3.2 Library Manager dialog in PADS PCB Editor

Click on the **Manage Lib. List...** button to open the **Library List** dialog.

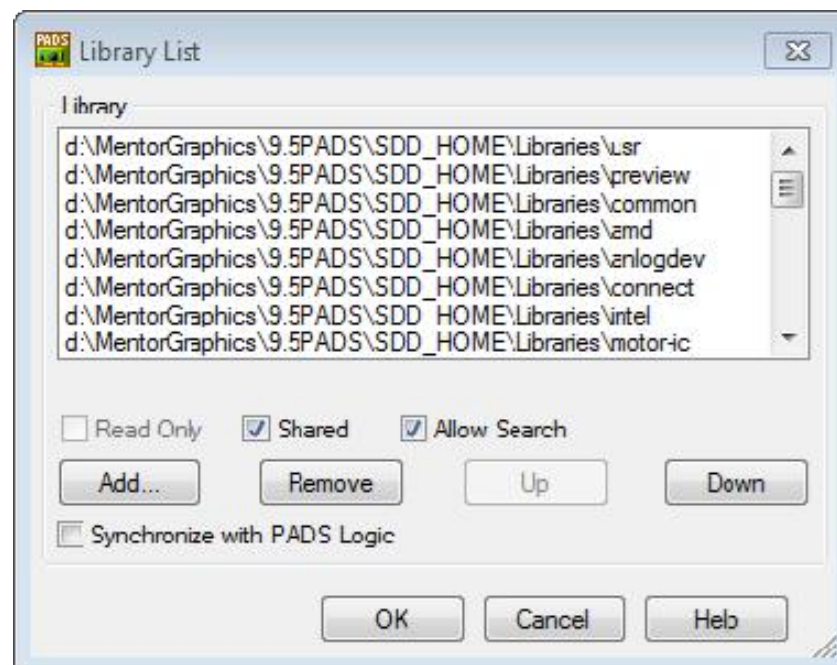


Figure 3.3 Library List dialog in PADS PCB Editor

Click on the **Add** button to open a windows file selection dialog, browse to the **PADS\_Net\_List\_Library\Pads\_Libraries\** folder and select each of the **\*.pt9** files, then click the **Open** button to add them to the Library List.

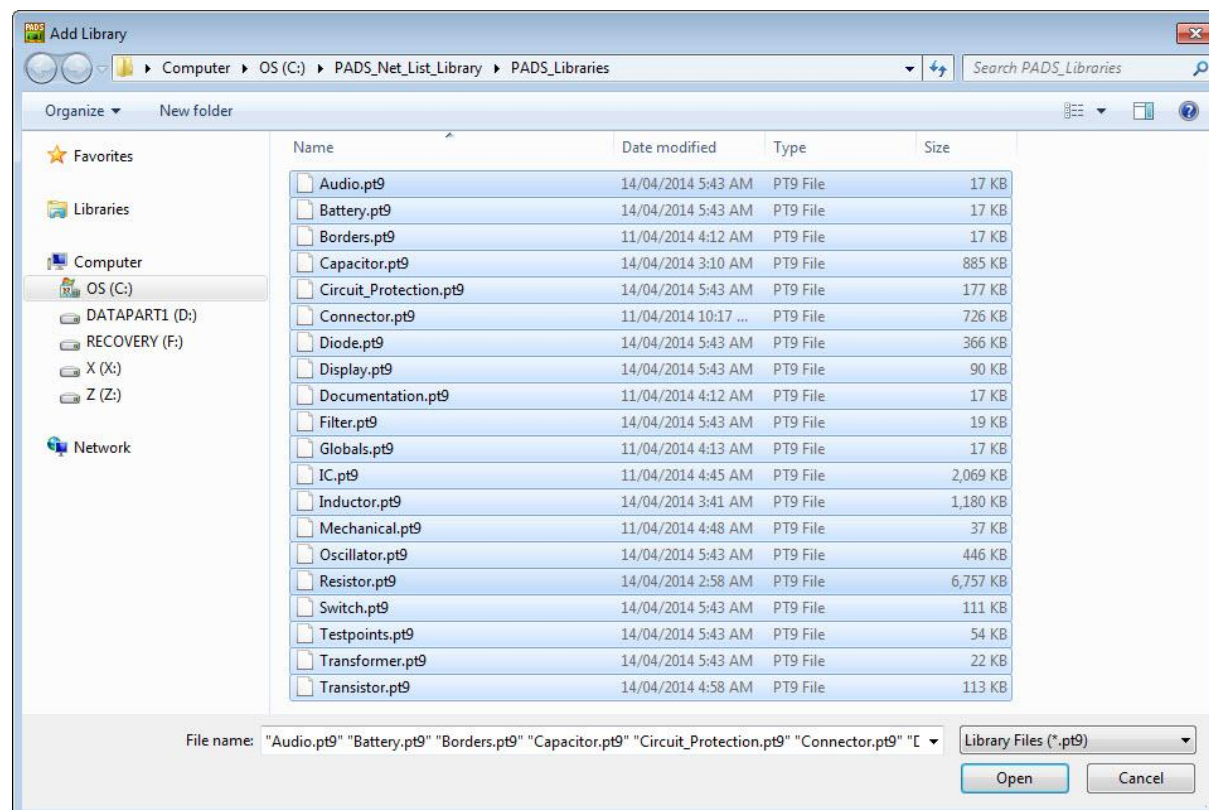


Figure 3.4 Selecting the \*.pt9 files

This adds all of the libraries to the list of available libraries in PADS PCB. You can scroll to the bottom of the Library List in PADS to see the libraries added.

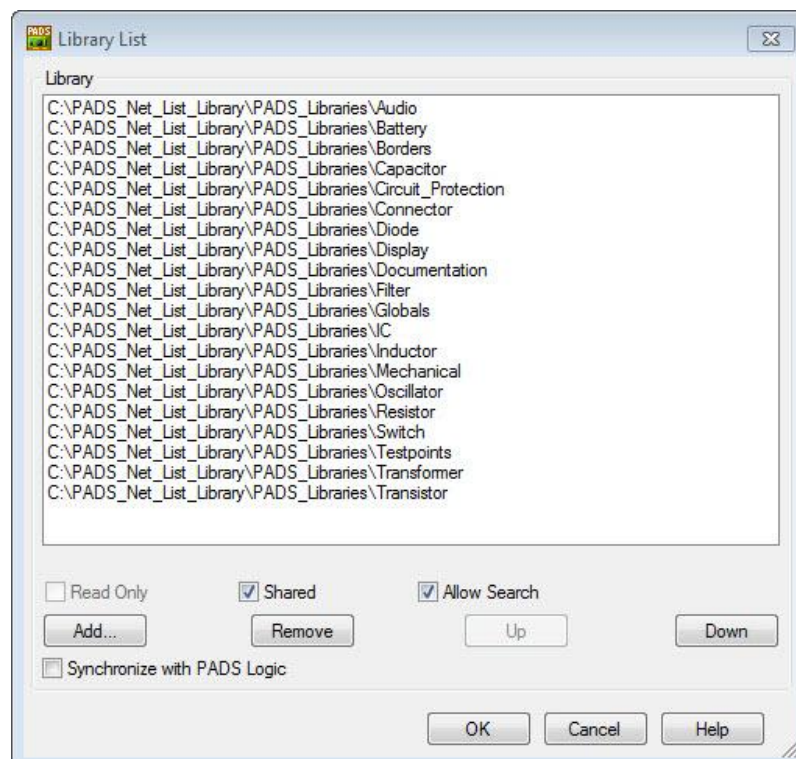


Figure 3.5 Libraries added to PADS Library List

In the PADS Library Manager dialog you can now select any of the \*.pt9 libraries from the list of available libraries and then click on the Decals, Parts or 2D Lines buttons to browse the list of entities available in each part of the library.

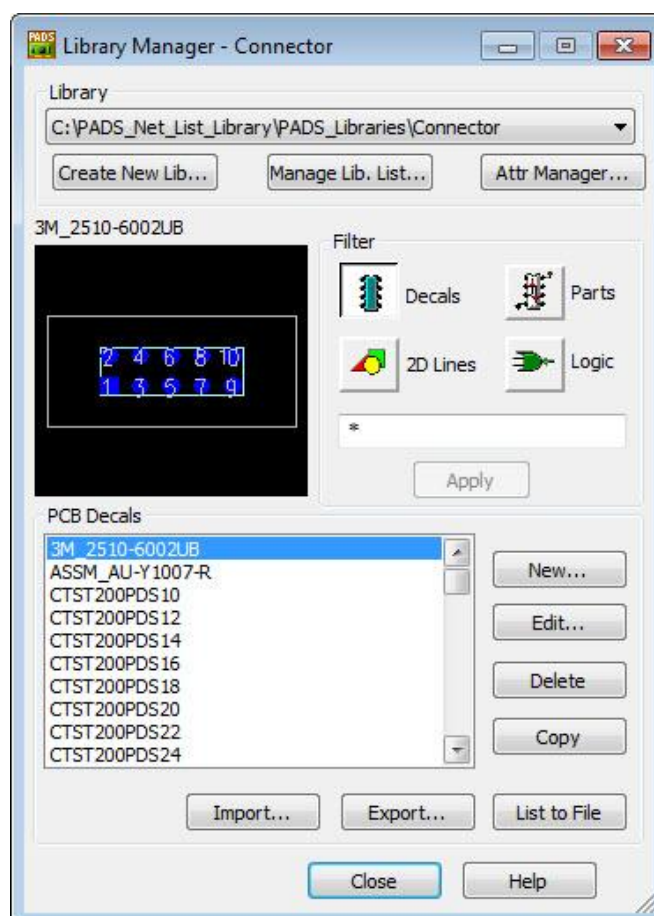


Figure 3.6 Browsing the contents of the Decal library

## Re-Configuration

If you move the library to another path after the initial installation, you must re-configure certain items in existing projects and templates in order for the design flow to work correctly. Re-configure your workflow using the Setup > Settings dialog in DxDesigner.

1. Modify the library paths for the Special Components and Border Symbols.

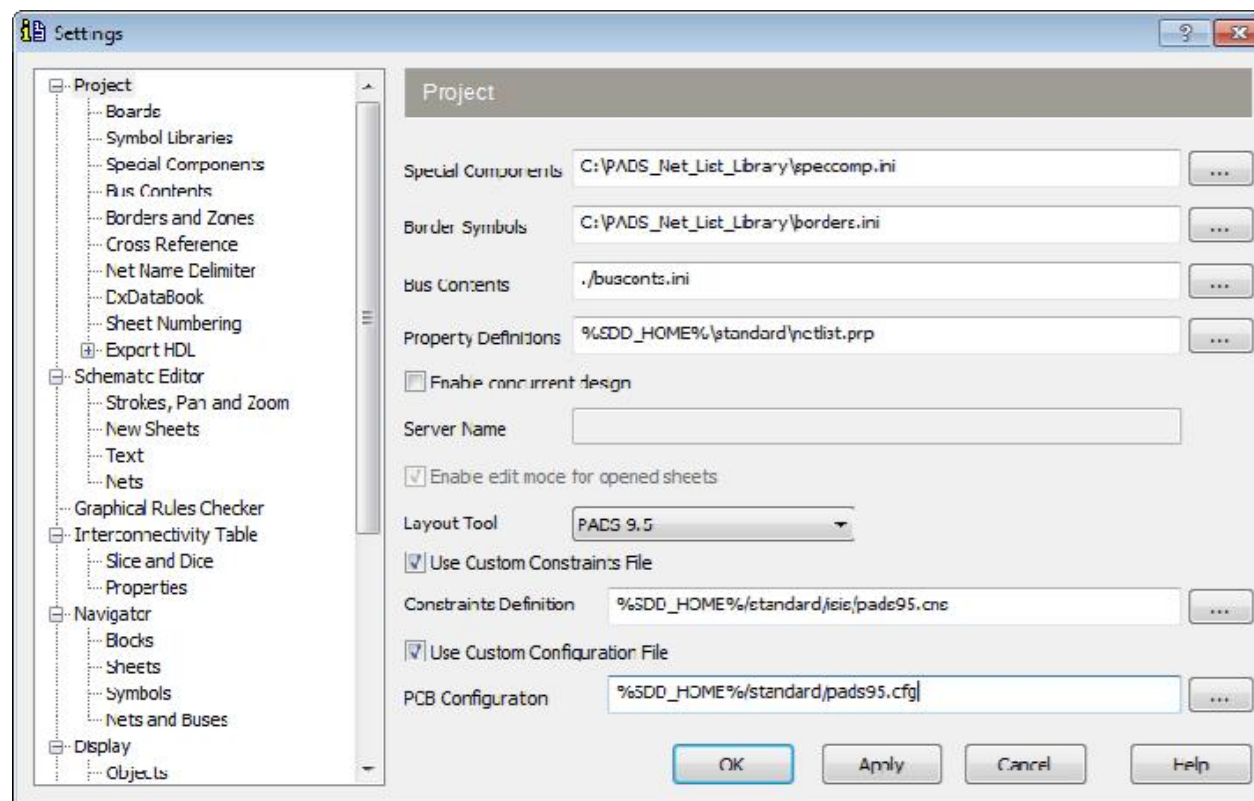


Figure 4.1 Library Path Settings in DxDesigner

2. Define the path to the DxDataBook Configuration (.dbc) file using the **Setup > Settings** Dialog.

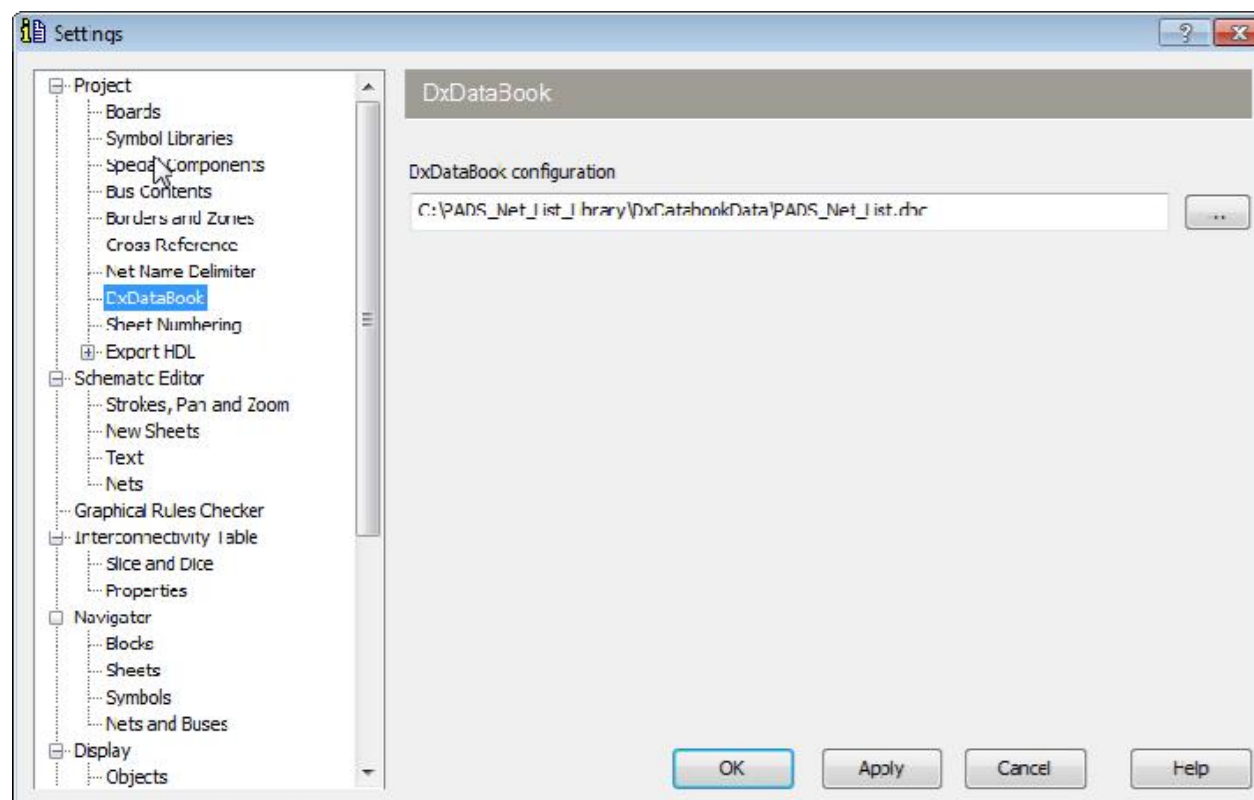


Figure 4.2 DxDataBook Configuration File Location

# Access Database and DxDatabook

## Access Database Definition

The PADS\_Net\_List\_library uses a Microsoft® Access® Database, **Databook.mdb**, as the ODBC data source. Throughout this document it is simply referred to as, “database.”

The database is used as a source for device data, which is then attached to symbols in a DxDesigner schematic. This is achieved by placing devices from DxDatabook, which provides the link to the database.

Many different configurations of a database can be used with DxDesigner, such as linked tables and queries, but our aim is to keep things as simple as possible. For this reason the database structure is very basic. The tables are organized according to device types. If a field is not relevant to a particular type of device, it is simply left blank.

## Device Data

All of the required data needed to produce a schematic, Bill Of Materials (BOM), and successful forward annotation into PADS PCB is contained in the database. This includes references for:

- DxDesigner symbols
- Manufacturer part numbers
- PADS Decals

Various other data are also included for use at the discretion of the end user.

## Database Tables

**AUDIO** – Buzzers, Speakers

**BATTERY** – Batteries

**CAPACITOR\*** – Capacitors

**CIRCUIT\_PROTECTION** – Fuses

**CONNECTOR** – Connectors, Terminal Blocks

**DIODE** – Diodes, Bridge Rectifiers, Transient Voltage Suppressors

**DISPLAY** – LEDs, Optoelectronics, Displays

**DOCUMENTATION** – Documents

**FILTER** – Filters

**FPGA** – FPGAs and configuration

**IC** – Integrated circuit symbols.

**INDUCTOR\*** – Inductors

**MECHANICAL** – Hardware, nuts and bolts etc, Mounting Holes

**OSCILLATOR** – Oscillators and Crystals

**RESISTOR\*** – Resistors and Trimpots

**SWITCH** – Switches and Relays

**TESTPOINTS** – Testpoints, pins, pads, ICT

**TRANSFORMERS** – Transformers

**TRANSISTOR** – Transistors and MOSFETs

**\*Note:** The CAPACITOR, INDUCTOR, and RESISTOR tables listed above contain devices that do not have any manufacturer part number data. This allows the user to quickly place these devices without having to know its part number in advance. After placement, part numbers can then be added, or the generic devices can be replaced with actual devices in the schematic. It is also possible to add the part numbers at the BOM level without updating the schematic, if so desired.

## Component Libraries

The component libraries in DxDatabook have a one-to-one relationship to the tables in the Access database, **Databook.mdb**. The component library structure is, therefore, exactly the same as the table structure in the database, **Databook.mdb**. These tables show up in DxDatabook as the searchable component libraries from which devices are selected and then dragged onto the schematic page. The field structure is as follows.

## Property Definition

When devices are placed from DxDatabook, all of the property information that is contained in the database tables is brought into the instance of that device on the schematic.

There are four different DxDatabook field types. They are defined in DxDatabook as:

- Document - Provides a link to the document in the query results window
- Normal - Normal field type
- Symbol - Contains the symbol to be used for a part
- Unused - Ignored field type

The following table lists all of the fields in the DxDatabook configuration, and the name of the properties in DxDesigner to which they are mapped.

## Database Fields

| DATABASE FIELD NAME           | MAPPED DxDesigner PROPERTY | DESCRIPTION                        | Library Definition       | DxDatabook FIELD TYPE |
|-------------------------------|----------------------------|------------------------------------|--------------------------|-----------------------|
| Part Number                   | DEVICE                     | Manufacturer part number           | Defined                  | Normal                |
| Symbol                        | Name of schematic symbol   | DxDesigner symbol name             | Defined                  | Symbol                |
| Footprint                     | PKG_TYPE                   | PADS Decal name                    | Defined                  | Normal                |
| Value                         | Value                      | Device value                       | Defined where applicable | Normal                |
| Tolerance                     | Tolerance                  | Device tolerance                   | Defined where applicable | Normal                |
| Rated Voltage                 | RatedVoltage               | Device voltage in volts            | Blank - End User Defined | Normal                |
| Rated Current                 | RatedCurrent               | Device current in amps             | Blank - End User Defined | Normal                |
| Rated Power                   | RatedPower                 | Device power in watts              | Blank - End User Defined | Normal                |
| Status                        | Status                     | Status                             | Blank - End User Defined | Normal                |
| Manufacturer Part Number      | ManufacturerPN             | Manufacturer's part number         | Defined                  | Normal                |
| Manufacturer Name             | Manufacturer               | Manufacturer's name                | Defined                  | Normal                |
| Manufacturer Part Description | Description                | Manufacturer's description of part | Defined                  | Normal                |
| Manufacturer Link             | ManufacturerLink           | Link to manufacturer website       | Blank - End User Defined | Document              |
| Supplier Part Number          | SupplierPN                 | Supplier's part number             | Blank - End User Defined | Normal                |
| Supplier Name                 | Supplier                   | Supplier's name                    | Blank - End User Defined |                       |
| Supplier Category             | SupplierCategory           | Supplier's device category         | Blank - End User Defined | Normal                |
| Supplier Sub-Category         | SupplierSubCategory        | Supplier's device sub-category     | Blank - End User Defined | Normal                |
| Supplier Link                 | SupplierLink               | Link to supplier website           | Blank - End User Defined | Document              |
| Datasheet Link                | Datasheet                  | Link to datasheet                  | Blank - End User Defined | Document              |
| Photo Link                    | Photo                      | Link to device photo               | Blank - End User Defined | Document              |
| Resistance                    | Resistance                 | Device resistance                  | Blank - End User Defined | Normal                |
| Capacitance                   | Capacitance                | Device capacitance                 | Blank - End User Defined | Normal                |
| Inductance                    | Inductance                 | Device inductance                  | Blank - End User Defined | Normal                |
| Package                       | Package                    | Industry standard package name     | Defined                  | Normal                |
| Component Type                | Component Type             | Device type                        | Defined                  | Normal                |
| Cost                          | Cost                       | Cost                               | Blank - End User Defined | Normal                |
| Part Name                     | Part Name                  | Part name                          | Future use               | Normal                |
| Part Label                    | Part Label                 | Part Label                         | Future use               | Normal                |
| Part ID                       | Part_ID                    | PartID                             | Future use               | Unique ID             |

Figure 5.1 Database Fields

## Field Definitions

Fields are described as:

- REQUIRED – essential for successful forward annotation to PADS PCB
- OPTIONAL – preferable to have a value entered, but not essential
- END USER – Value is end-user specific

### **Part Number**

REQUIRED: The manufacturer part number is used for Part Number for all specific devices. In the case of resistor, capacitor and inductor, a generic descriptive part number is used for the base values of each size.

The value in this field is synced to the DEVICE property in the corresponding PADS Part Library.

The part number field value may be replaced by a company's internal part number since the manufacturer part number is also defined in its own field.

### **Symbol**

REQUIRED: The value of this field determines the symbol that will be used when the device is selected from DxDatabook for placement on the schematic. The exclusion of a file extension (.1, .2, etc.) in the symbol name allows the use of any of the multiple symbols with the same name. For example, cap.1, cap.2, cap.3, or cap.4 can all be selected from DxDatabook for any device that has 'cap' as the symbol name. This allows for different rotations and views of the symbol to be selected for placement.

And asterisk character at the end of the symbol name allows for all symbols in a Hetero set to become available for placement on the schematic i.e. xc7vx415t-ff1927\*

### **Footprint**

REQUIRED: The value in this field is synced to the PKG\_TYPE property which is the Decal name used in the PADS Part Library.

### **Value**

OPTIONAL: This is the value of discrete devices (RES, CAP, etc.) – in Ohms, Farads, Henrys, or Hertz. It is only used in Resistor, Capacitor, Inductor and Oscillator.

### **Tolerance**

OPTIONAL: This field contains the device's tolerance.

### **Rated Voltage**

OPTIONAL: This field contains the voltage rating of the device in volts.

### **Rated Current**

OPTIONAL: This field contains the current rating of the device in amps.

### **Rated Power**

OPTIONAL: This field contains the power rating of the device in watts.

### **Status**

END USER: Can be used to record verification that a device entry has been checked.

### **Manufacturer Part Number**

END USER: This field contains the manufacturer's complete part number.

### **Manufacturer Name**

END USER: This field contains the manufacturer's name.

**Manufacturer Part Description**

END USER: This field contains the manufacturer's part description.

**Manufacturer Link**

END USER: This field contains a link to the manufacturer's website.

**Supplier Part Number**

END USER: This field contains the supplier's part number.

**Supplier Name**

END USER: This field contains the supplier's name.

**Supplier Category**

END USER: This field can be used to categorize the device.

**Supplier Sub-Category**

END USER: This field can be used to categorize the device to a further level.

**Supplier Link**

END USER: This field contains a link to the supplier's website.

**Datasheet Link**

END USER: This field contains a link to the datasheet for the device. It can be used to link a path to a repository or to a web address to the datasheet on a manufacturer's website.

**Photo Link**

END USER: This field contains a link to a photo of the device.

**Resistance**

END USER: This field contains the resistance of the device.

**Capacitance**

END USER: This field contains the capacitance of the device.

**Inductance**

END USER: This field contains the inductance of the device.

**Package**

END USER: The industry standard package name (0805, SO8, BGA48, etc.) or SMD/THP.  
It is NOT the PADS Decal name.

**Component Type**

END USER: This is simply the type of component, e.g., IC, CAPACITOR, etc. It can be used for sorting devices.

**COST**

END USER: This field is for the end user to record the cost of the device.

### **Part Name**

END USER: This field is for future use to sync to the pdb Part Name in LMC.

### **Part Label**

END USER: This field is for future use to sync to the pdb Part Label in LMC.

### **Part ID**

END USER: This field is for future use.

## **Searching for Devices**

DxDatabook allows the user to find devices very easily with the use of a comprehensive database search engine. Any of the database fields can be searched with a variety of search operators to quickly find the required device.

Note that the value is recorded in the Access database as base units Ohms, Farads, Henrys, and Hertz. For example:

100K is recorded as 100000  
100pf is 0.00000000010000  
470uf is 0.000470000000000  
25MHz is 25000000

But in the DxDatabook and on the schematic, the values show as

100K  
100pf  
470uf  
25MEGHZ

This applies to the following tables:

RESISTOR  
CAPACITOR  
INDUCTOR  
OSCILLATOR

# Symbols

## The Symbols Library's Structure

### Short descriptions of Symbol Libraries

|                           |                                                             |
|---------------------------|-------------------------------------------------------------|
| <b>Audio</b>              | Buzzers and speakers                                        |
| <b>Battery</b>            | Batteries                                                   |
| <b>Capacitor</b>          | Capacitors                                                  |
| <b>Circuit_Protection</b> | Fuses and circuit breakers                                  |
| <b>Connector</b>          | Plug and socket symbols for all part types of connectors    |
| <b>Diode</b>              | Diodes, Transient Voltage Suppressors and bridge rectifiers |
| <b>Display</b>            | LEDs, Optoelectronics and displays                          |
| <b>Documentation</b>      | Documentation symbols, bus ripper, page in/out/bi           |
| <b>Filter</b>             | Filters                                                     |
| <b>Globals</b>            | Power and Ground symbols                                    |
| <b>IC</b>                 | Integrated circuit symbols                                  |
| <b>Inductor</b>           | Inductors                                                   |
| <b>Mechanical</b>         | Hardware, nuts and bolts etc, Mounting Holes                |
| <b>Oscillator</b>         | Oscillators and Crystals                                    |
| <b>Resistor</b>           | Resistors                                                   |
| <b>Switch</b>             | Switches and Relays                                         |
| <b>Transformer</b>        | Transformers                                                |
| <b>Transistor</b>         | Transistors and MOSFETs                                     |

## Typical IC Symbol Structure

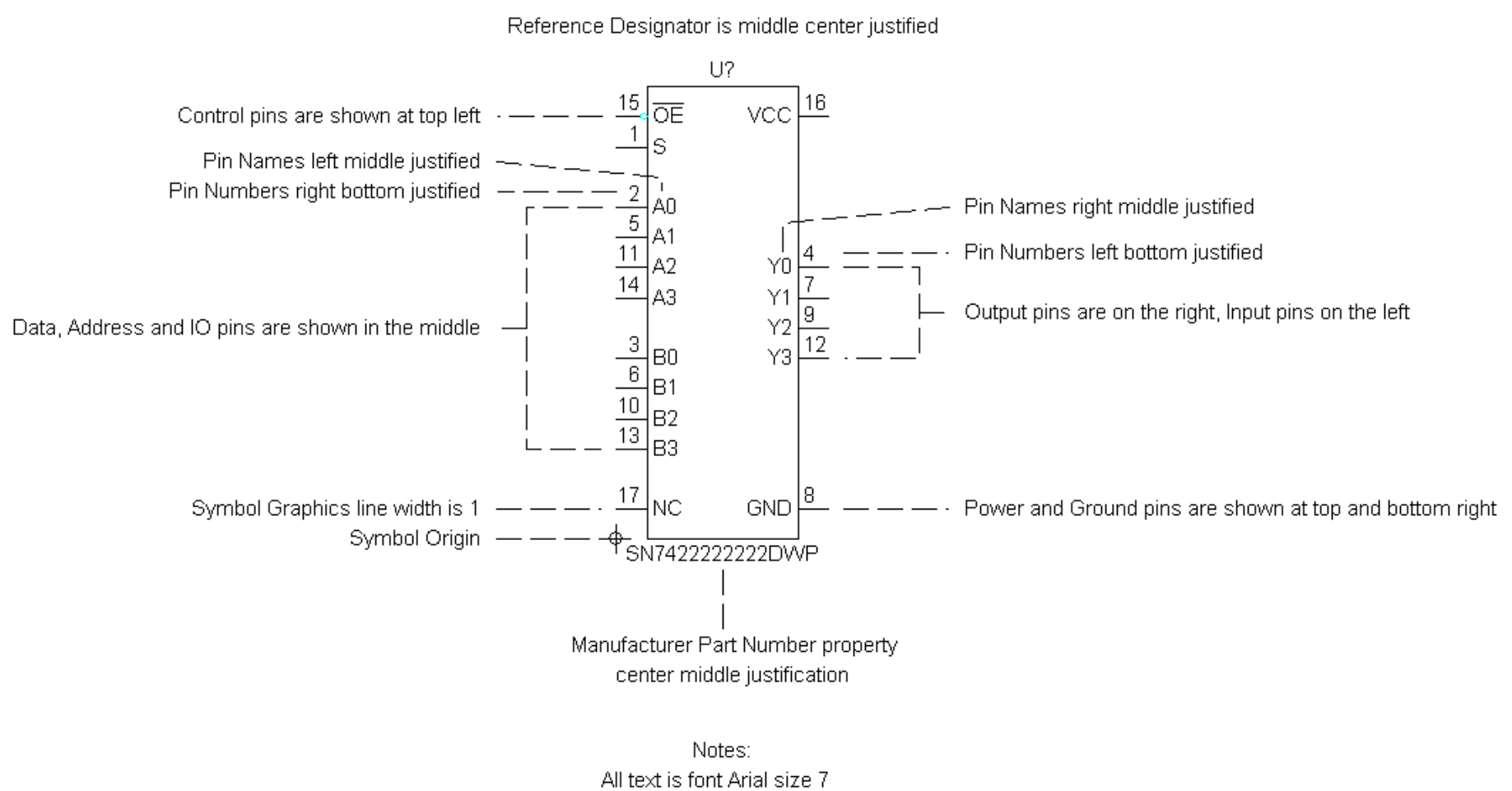


Figure 6.1 Typical IC Symbol Structure

## Symbol Naming Conventions

- **Symbol Name Prefixes**

The symbol prefixes (where used) are self-explanatory as to what part type the component symbol represents, and most are in the form of widely used, industry-standard abbreviations. For example, plg = plug, cap = capacitor, etc.

- **Manufacturer part number qualifiers**

Many symbols simply use the manufacturer part number as the symbol name qualifier. This convention is mainly used for ICs, but may be used for other symbols where deemed appropriate.

IC symbol naming is in the form of *base manufacturer part number–package*

For example, symbol name lt1618-dfn10h.

Linear Technology part number lt1618 dual flat no lead 10 pin heatsink pad

- **Multiple symbol qualifiers**

**pin group qualifiers** (suffix), are used to name the separate symbols used in a device according to the various pin groups; for example, -gnd, -cfg, -bnk2

- **Part type qualifiers**

As well as using the part type prefixes, many symbols also use other descriptive part type qualifiers in their naming conventions. Most of these qualifiers are readily identifiable as industry standard abbreviations. For example, var = variable, pol = polarized. For a list of part type qualifiers, see the Abbreviations Section later in this document.

- **Package type qualifiers**

IC symbols *may* contain a package type suffix where devices are available in different package pinouts.

For example, dil = dual in line, qfn = quad flat no lead.

Some generic style IC symbols do not have the suffix.

For example, reg-iiia = regulator with 2 input, an output and an adjust pin in any package

- **Pin number qualifiers in symbol names**

Symbols have pin number information included in the symbol name. This is our preferred method of making symbols as generic as possible without the need for additional “side” files or attributes to manipulate pin orders and numbers.

For example, the symbol “**reg-iiia.1**” can be used for any regulator that has the pinout of 2 x input pins, 1 x output pin and 1 x adjust pin.

“**mosfet-n-gdsss**” can be used for any n channel mosfet with 1 x gate pin, 1 x drain pin and 3 x source pins

This method enables the use of one symbol for many different devices. This naming convention may be used for any part type having a maximum of 8 pins. A list of the letters used and their meanings can be found in the Abbreviations Section later in this document.

- **File extensions in symbol names**

Each symbol is stored in the form of a text file, with the file extension of .1, .2, .3, and so on. Different symbol file extensions are used to depict different views of the device. This enables the user to:

- Place different symbol views that have all of their text in the correct orientation  
All of the widely used 2-pin symbols, such as res and cap, have a symbol with both a .1 and a .2 extension.
  - .1 = horizontal view
  - .2 = vertical view
- Have symbols that allow for closer placement of symbols without overlapping text/graphics  
These are generally used for pull up or pull down resistor groups.
  - .3 = horizontal slimline
  - .4 = vertical slimline

Having the different views reduces the need to continually rotate text to match the view of the symbol.

By not including the file extension in the DxDatabook entry, all symbols with the matching base symbol name are available in the DxDatabook symbol selection window.

- **Connector Symbols**

All generic connector symbols are created as single pin symbols that are placed x times on the schematic according to the number of pins on the connector.

Connectors that use specific pin names for industry standard pinouts are created as block symbols with all of the pins on one symbol.

- **Pin Names**

Due to the 40 character restriction for pin names, some devices have pin names that do not exactly match that of the datasheet. This mostly occurs on Altera FPGA devices due to their multi function pin names but may occur on other devices as well.

These devices may have some functions missing from the pin names and/or have abbreviated pin functions in the naming.

- **Pin Text**

Each pin name is unique. Duplicate pin names are not allowed because pins cannot be mapped in the layout tool if there are two pins with the same name.

If more than one pin performs the same function (e.g., a ground connection), then the pin names must still be different. These pins are typically differentiated with the addition of a number at the end of the pin name. For example, GND1, GND2, etc.

PIN NAMES may or may not be visible, depending on the symbol. As a general guide, pin names are not shown on discrete, connector, or logic gate symbols, whereas they are shown on IC symbols.

PIN NUMBERS may or may not be visible, depending on the symbol. As a general guide, pin numbers are not shown on discrete symbols, whereas they are shown on connector and IC symbols.

PIN TYPES are always invisible. Pin types used are IN, OUT, BI, TRI, and ANALOG.

## Symbol Pins

- **Pin connection points**

The connection point of a pin is determined by where the pin meets the symbol outline border. This outline appears as a white box around the symbol during symbol editing.

Pins can be moved around and rotated inside the outline, and can be of any length within that outline, but the connection point remains where the pin meets the outline.

- **Pin shapes**

There are four pin shapes on the symbols. Normal and inverted pins consist of the pin only (no drawn graphics are used), whereas the clock pins are a normal pin plus a clock graphic. The dot pins are created with the use of the “invert pin option.”

Normal – active high input or output

Dot – active low input or output

Clock – active high clock input or output

Dot Clock – active low clock input or output

- **Negative logic pins**

Negative logic pins are signified with the use of overbars in the pin name. The overbar is created automatically by checking the “inverted” checkbox in the pin properties dialog. Selecting “invert pin” from the same dialog will give the pin a “dot”/“bubble” pin. The size of the bubble is determined by the user in the schematic Setup – Settings – Advanced section. The recommended size for this library is 0.010

- **Power, ground and no-connect pins**

Power and ground pins are explicitly shown on the symbols that have only one gate or that are Hetero type 3 (multiple different one gate symbols used for one device). Implicit pins are used for all Hetero type 2 symbols (multiple gates of the same symbol i.e. logic gates, dual op-amps etc) The SIGNAL property is used to define the implicit pins.

No-connect pins are explicitly shown on all symbols.

## Abbreviations

The symbol library makes extensive use of abbreviations in symbol names.

This document is aimed at giving the end user a broad understanding of the abbreviations. While it is extensive, it is not an absolute list of every abbreviation used.

Many of the entities within the library are named without abbreviation and, therefore, do not appear in this index. This document is divided into two sections. The first section contains abbreviations for Part Type Qualifiers, and the second section contains abbreviations for Pin Type Qualifiers.

### • Part Type Qualifier Abbreviations

#### DISCRETES

| ABBREVIATION | TYPE                     |
|--------------|--------------------------|
| DIO          | DIODE                    |
| ZENER        | ZENER DIODE              |
| SCHTKY       | SCHOTTKY DIODE           |
| CAP          | CAPACITOR                |
| RES          | RESISTOR                 |
| IND          | INDUCTOR                 |
| VAR          | VARIABLE                 |
| POL          | POLARIZED                |
| PACK         | MULTIPLE GATES IN DEVICE |
| BUS          | BUSSED                   |

Figure 6.2 Discrete Qualifier Abbreviations

#### IC

| ABBREVIATION | TYPE                  |
|--------------|-----------------------|
| OPAMP        | OPERATIONAL AMPLIFIER |
| REG          | REGULATOR             |

Figure 6.3 IC Qualifier Abbreviations

#### MISC

| ABBREVIATION | TYPE                    |
|--------------|-------------------------|
| OSC          | OSCILLATOR              |
| PLG          | CONNECTOR PLUG (MALE)   |
| SKT          | CONNECTOR SKT (FEMALE)  |
| XFMR         | TRANSFORMER             |
| SIL or SIP   | SINGLE ROW IN LINE PINS |
| DIL or DIP   | DUAL ROW IN LINE PINS   |

Figure 6.4 Miscellaneous Part Abbreviations

- **Pin Type Qualifier Abbreviations**

**DIODE PINS**

| ABBREVIATION | TYPE            |
|--------------|-----------------|
| K            | CATHODE         |
| A            | ANODE           |
| BI           | BI DIRECTIONAL  |
| UNI          | UNI DIRECTIONAL |

*Figure 6.5 Diode Pin Abbreviations*

**MOSFET PINS**

| ABBREVIATION | TYPE   |
|--------------|--------|
| G            | GATE   |
| D            | DRAIN  |
| S            | SOURCE |

*Figure 6.6 MOSFET Pin Abbreviations*

**RELAY PINS**

| ABBREVIATION | TYPE            |
|--------------|-----------------|
| CL           | COIL            |
| CM           | COMMON          |
| NC           | NORMALLY CLOSED |
| NO           | NORMALLY OPEN   |

*Figure 6.7 Relay Pin Abbreviations*

**TRANSISTOR PINS**

| ABBREVIATION | TYPE      |
|--------------|-----------|
| C            | COLLECTOR |
| B            | BASE      |
| E            | EMITTER   |

*Figure 6.8 Transistor Pin Abbreviations*

**TRIMPOTS**

| ABBREVIATION | TYPE           |
|--------------|----------------|
| MIN          | MINIMUM (CCW)  |
| MAX          | MAXIMUM (CW)   |
| ADJ          | ADJUST (WIPER) |

*Figure 6.9 Trimpot Pin Abbreviations*

| <b>IC PINS</b>      |                            |
|---------------------|----------------------------|
| <b>ABBREVIATION</b> | <b>TYPE</b>                |
| I                   | INPUT                      |
| O                   | OUTPUT                     |
| G                   | GROUND                     |
| AG                  | ANALOG GROUND              |
| V                   | VCC                        |
| VE                  | VEE                        |
| VD                  | VDD                        |
| NC                  | NO CONNECT                 |
| ENH                 | ENABLE HIGH                |
| ENL                 | ENABLE LOW                 |
| RSTH                | RESET HIGH                 |
| RSTL                | RESET LOW                  |
| PWR                 | POWER                      |
| ADJ                 | ADJUST                     |
| POS                 | POSITIVE                   |
| NEG                 | NEGATIVE                   |
| VREF                | VOLTAGE REFERENCE          |
| FB                  | FEEDBACK                   |
| SHDN                | SHUTDOWN                   |
| H                   | HEATSINK PIN / THERMAL PAD |

*Figure 6.10 IC Pin Abbreviations*

# Land Pattern Specification

This section describes the naming conventions and parameters used for the land pattern creation in the PADS\_Net\_List\_Library. It is based on the IPC7351B Generic Requirements for Surface Mount Design and Land Pattern Standard.

Land patterns are built to IPC7351B or in some cases, to manufacturer recommended land pattern. The naming conventions clearly denote which has been used later in this document

All units are in millimeters (mm) throughout this document unless otherwise noted.

Some definitions have been created for future use to ensure uniformity of naming if this document is used.

## Notes:

- Not all name modifiers and options defined in this section are used in the library.
- There are no Padstacks defined in the PADS libraries, pads are defined at the Decal level.
- There are no Thermal Pads defined in the PADS Decal libraries, these are user controlled in the planes processing procedures in the PADS PCB tool. If users require the thermal pads the be defined in the Decals then this can easily be be done the user.

## Naming Convention Overview

The following section details the naming convention for ODA land patterns, padstacks and pads. The land pattern naming convention is based on the IPC7351B land pattern naming convention for IPC type SMD components. Additional conventions are added for ease of identification or due to limitations of the IPC naming convention.

### Height :

Except for aluminum electrolytic capacitors and two pin crystals, the height convention is removed from the naming convention to reduce duplication of land patterns where height can be introduced into the design via external toolsets.

### Character Limitation:

Land pattern names have a 31 character limitation. The period (.) and space characters will not be used in any library entities. Adhering to these rules for land pattern names will allow for easier library and layout database translation to other systems when required.

### Typography and numbering convention:

All units in the library are metric as follows:

- 2 decimal places resolution for hole sizes.
- 3 decimal places resolution for Pads and hole tolerances.

Square brackets “[ ]” are used to indicate optional values.

Forward slash “ / ” is used to indicate alternate values.

## Soldermask Default

All soldermask openings are defined in the PADS Decals. Default soldermask condition is 0.100mm over the pad size or over the drill size for non plated holes where the drill is larger than the pad.

## Paste mask Default

All Decals have paste mask defined. Default pastemask condition for all SMD pads is the same size as the pad.

## Drill Dimensions

Drill diameters are rounded up to the nearest 0.05mm. This table shows the drill size used based on the lead diameter when the hole size is not defined by the manufacturer.

Press fit pins do not follow this rule, they are defined with the size and tolerance specified in the manufacturer data sheet.

The minimum annular ring and pad size for each drill diameter is also referenced. The annular ring may be reduced at the librarian's discretion if the pin to pin spacing is an issue.

| LEAD DIA <= | DRILL DIA <= | PAD DIA <= | ANNULAR RING |
|-------------|--------------|------------|--------------|
| 0.05        | 0.40         | 0.90       | 0.50         |
| 0.10        | 0.45         | 0.95       |              |
| 0.15        | 0.50         | 1.00       |              |
| 0.20        | 0.55         | 1.05       |              |
| 0.25        | 0.60         | 1.10       |              |
| 0.30        | 0.65         | 1.15       |              |
| 0.35        | 0.70         | 1.20       |              |
| 0.40        | 0.75         | 1.25       |              |
| 0.45        | 0.80         | 1.30       |              |
| 0.50        | 0.85         | 1.35       |              |
| 0.55        | 0.90         | 1.40       |              |
| 0.60        | 0.95         | 1.45       |              |
| 0.65        | 1.00         | 1.50       |              |
| 0.70        | 1.05         | 1.55       |              |
| 0.75        | 1.10         | 1.85       | 0.75         |
| 0.80        | 1.15         | 1.90       |              |
| 0.85        | 1.20         | 1.95       |              |
| 0.90        | 1.25         | 2.00       |              |
| 0.95        | 1.30         | 2.05       |              |
| 1.00        | 1.35         | 2.10       |              |
| 1.05        | 1.40         | 2.15       |              |
| 1.10        | 1.45         | 2.20       |              |
| 1.15        | 1.50         | 2.25       |              |
| 1.20        | 1.55         | 2.30       |              |
| 1.25        | 1.60         | 2.35       |              |
| 1.30        | 1.65         | 2.40       |              |
| 1.35        | 1.70         | 2.45       |              |
| 1.40        | 1.75         | 2.50       |              |
| 1.45        | 1.80         | 2.55       |              |
| 1.50        | 1.85         | 2.60       |              |
| 1.55        | 1.90         | 2.65       | 1.00         |
| 1.60        | 1.95         | 2.95       |              |
| 1.65        | 2.00         | 3.00       |              |
| 1.70        | 2.05         | 3.05       |              |
| 1.75        | 2.10         | 3.10       |              |
| 1.80        | 2.15         | 3.15       |              |
| 1.85        | 2.20         | 3.20       |              |
| 1.90        | 2.25         | 3.25       |              |
| 1.95        | 2.30         | 3.30       |              |
| 2.00        | 2.35         | 3.35       |              |
| 2.05        | 2.40         | 3.40       |              |
| 2.10        | 2.45         | 3.45       |              |
| 2.15        | 2.50         | 3.50       |              |
| 2.20        | 2.55         | 3.55       |              |
| >= 2.25     | >= 2.6       |            | 1.3          |

Figure 7.1 Pad and Drill parameters

## Land patterns (Decals)

PADS Decals are referred to as Land Patterns throughout this document.

Land Patterns are created to IPC standard or to manufacturer recommended land patterns if IPC does not apply.

## Land Pattern Naming Conventions

The naming conventions used in the library are based on IPC7351 naming convention but not exactly the same as IPC7351B.

The key differences are:

Land pattern names do not include height; the height is determined at the pdb level.

There is a length (D) dimension added to the land pattern names for dual in line parts such as SOICs and SOPs

Some land patterns retain naming conventions from previous IPC7351 versions. These land patterns conform to IPC7351B, it is only the name that is from the earlier version.

## Naming conventions rules

- Units of measure - Dimensions are defined using the metric system. In some instances, imperial (inch) units may be appended to the land pattern name. This is done to reduce confusion between the metric dimension and the commonly used industry name. Each component naming convention will have the resolution defined in its description. An example is the metric 0603, which is commonly known as an industry 0201.
- Leading and trailing zeros - Leading zeros are not required. Trailing zeros are required to meet the components resolution definition.
- Land pattern name length will be a maximum of 31 characters.
- Typographical Convention.
  - The \_ (underscore) is used as a separator between different fields of a land pattern name. The underscore may also be used in place of the period (.) character.
  - The – IPC uses the dash as a separator for the pin quantity field, the dash is replaced by an underscore in this library for this purpose. The dash is also used within the pin qty to determine missing numbers of pins, i.e. 24-28 indicates a 28 pin package in which only 24 pins are used.
  - The X (uppercase letter X) is used between dimensions. LengthXWidthXHeight.
  - The M, N, L, Q, suffixes are to appear at the end of every common SMD land pattern name. They represent Maximum, Nominal, and Least land size conditions respectively. This rule excludes BGA packaged land patterns where only nominal is defined. The Q suffix denotes that the manufacturer recommended land pattern has been used for the land pattern.
  - THROUGH-HOLE components do not use a density level suffix.
  - The ( ) is used to denote required information to be added to the naming convention.
  - The [ ] is used to denote optional information to be added to the naming convention.
  - Only alphanumerics, underscores “\_”, and dashes “-” are acceptable characters.
  - Defined Suffixes - The suffixes on the following page have been defined for various different component types.

## • Defined Suffixes

|                   |                                                                                                                                                                                                                                                                                    |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>_D####</b>     | Length of body of dual in line components, SOIC, SOP etc.                                                                                                                                                                                                                          |
| <b>_SKT</b>       | Socket as in IC or relay (not used on connectors).                                                                                                                                                                                                                                 |
| <b>_HS####</b>    | Heatsink. Used to denote the pad size for a thermal pad. If used, it will appear immediately prior to M, N, L at the end of the name or at the end for BGA and through-hole package land patterns.                                                                                 |
| <b>_VIA</b>       | Vias. Used for mounting holes with a via ring. If used, it appears immediately prior to M, N, L at the end of the name or at the end for BGA and through-hole package land patterns.                                                                                               |
| <b>_T or TVIA</b> | Thermal pad or Thermal pad with embedded vias. If used, it appears immediately prior to M, N, L at the end of the name or at the end for BGA and through-hole packages.                                                                                                            |
| <b>_###</b>       | Used to define alternate pin numbering scheme where ### = pin numbers/letters when the land pattern is viewed in the IPC defined zero orientation. Typically used on SOT and TO devices. Typical examples are SOT95P237_3_D290_231N, SOT95P237_3_D290_BECN, SOT95P237_3_D290_GSDN. |
| <b>_P2</b>        | Denotes that the positive is pin 2 on polarized packages (default is positive on pin1).                                                                                                                                                                                            |
| <b>_BIDIR</b>     | Bidirectional version of normally polarized devices i.e electrolytic capacitors and diodes etc.                                                                                                                                                                                    |
| <b>_RA</b>        | Denotes Right Angle.                                                                                                                                                                                                                                                               |
| <b>_IS</b>        | Optional suffix used to show the commonly used industry wide name for a given part. An example is the metric 0603, which is commonly known as an industry 0201.                                                                                                                    |
| <b>_C1</b>        | Pin 1 is located at the center of the package instead of the expected corner.                                                                                                                                                                                                      |
| <b>_#</b>         | Arbitrary suffix used for denote different cells that would otherwise have the same land pattern name. Start with 1 and increment by 1 for each alternate cell. Denote differences in the description field.                                                                       |
| <b>_24-26</b>     | Denotes 24 pins in a 26 pin package.                                                                                                                                                                                                                                               |
| <b>_GW</b>        | denotes gull wing leads                                                                                                                                                                                                                                                            |
| <b>_J</b>         | Denotes "J" leads.                                                                                                                                                                                                                                                                 |
| <b>_PD#</b>       | Denotes the physical pin diameter.                                                                                                                                                                                                                                                 |
| <b>_RV</b>        | Denotes that a reverse pinout is used i.e. 654321 instead of 123456.                                                                                                                                                                                                               |
| <b>_PMH</b>       | Denotes that Plated Mounting Holes are used for mounting pins.                                                                                                                                                                                                                     |
| <b>_BWT</b>       | Denotes Bottom Wave Technology                                                                                                                                                                                                                                                     |
| <b>_TDN</b>       | Denotes tie down holes built in to the land pattern.                                                                                                                                                                                                                               |

Figure 7.2 Defined Suffixes

## • Naming convention IPC table

| Description / Category                                | IPC Land pattern Name                                                                                                                                                           | suffixes         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Ball grid array                                       | <b>BGA</b> (pitch) <b>P</b> (#_of_pin_col) <b>X</b> (#_of_pin_rows)_(Pin_qty) _(body_widthXlength) (DL)                                                                         |                  |
| Ball grid array with different pin spacing in x and y | <b>BGA</b> (xpitch) <b>X</b> (ypitch) <b>P</b> (#_of_pin_col) <b>X</b> (#_of_pin_rows)_(Pin_qty) _(body_widthXlength) (DL)                                                      |                  |
| Ball grid array with staggered pins                   | <b>SBGA</b> (pitch) <b>P</b> (#_of_pin_col) <b>X</b> (#_of_pin_rows)_(Pin_qty) _(body_widthXlength) (DL)                                                                        |                  |
| Capacitor, Chip, Polarized                            | <b>CAPCP</b> (body size)(DL)                                                                                                                                                    | _(body_size_ths) |
| Capacitor, Chip, Non-polarized                        | <b>CAPC</b> (body size)(DL) chip parts >9.99mm in either x or y will have 4 digit body size dimensions for both x and y using X as a separator i.e (9.14mmx10.20mm = 9140X1020) | _(body_size_ths) |
| Capacitor, Chip, Wire Rectangle                       | <b>CAPCWR</b> (body size)(DL)                                                                                                                                                   | _(body_size_ths) |
| Capacitor, Chip, Array                                | <b>CAPAS</b> _(mfr)_(mfr_sern)_(Pin_qty) (DL)                                                                                                                                   |                  |
| Capacitor, Molded, Non-polarized                      | <b>CAPM</b> (body size)(DL)                                                                                                                                                     |                  |
| Capacitor, Molded, Polarized                          | <b>CAPMP</b> (body size)(DL)                                                                                                                                                    |                  |
| Capacitor, Aluminum Electrolytic                      | <b>CAPAE</b> (base body width) <b>W</b> (height) <b>H</b> (DL)                                                                                                                  |                  |
| Ceramic Flat Package                                  | <b>CFP127P</b> (Lead Span L1)_(Pin_qty)(DL) <b>_D</b> (body_length)                                                                                                             |                  |
| Column Grid Array                                     | <b>CGA</b> (#_of_pin_col) <b>X</b> (#_of_pin_rows)_(Pin_qty)(DL)                                                                                                                |                  |
| Diode, Molded                                         | <b>DIOM</b> (body size)(DL)                                                                                                                                                     |                  |
| Diode, MELF                                           | <b>DIOMELF</b> (body size)(DL)                                                                                                                                                  |                  |
| Inductor, Chip                                        | <b>INDC</b> (body size)(DL) chip parts >9.99mm in either x or y will have 4 digit body size dimensions for both x and y using X as a separator i.e (9.14x10.20 = 9140X1020)     | _(body_size_ths) |
| Inductor, Chip, Array                                 | <b>INDAS</b> _(mfr)_(mfr_sern)_(Pin_qty) (DL)                                                                                                                                   |                  |
| Inductor, Molded                                      | <b>INDM</b> (body size)(DL)                                                                                                                                                     |                  |
| Inductor, Precision Wire Wound                        | <b>INDP</b> (body size)(DL)                                                                                                                                                     |                  |
| Plastic Leaded Chip Carrier Square                    | <b>PLCC</b> (pitch) <b>P</b> (Lead Span L1) <b>X</b> (Lead Span L2)_(Pin_qty)                                                                                                   |                  |
| Plastic Leaded Chip Carrier Sockets Square            | <b>PLCCS</b> (pitch) <b>P</b> (Lead Span L1) <b>X</b> (Lead Span L2)_(Pin_qty)                                                                                                  |                  |
| Quad Flat Package                                     | <b>QFP</b> (pitch) <b>P</b> (Lead Span L1) <b>X</b> (Lead Span L2)_(Pin_qty)(DL)                                                                                                |                  |

| Description / Category                                                      | IPC Land pattern Name                                                                                                                                                       | suffixes                   |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Ceramic Quad Flat Package                                                   | <b>CQFP</b> (pitch) <b>P</b> (Lead Span L1) <b>X</b> (Lead Span L2)_(Pin_qty)(DL)                                                                                           |                            |
| Quad Flat No Lead Package                                                   | <b>QFN</b> (pitch) <b>P</b> (body_width) <b>X</b> (body_length)_(Pin_qty)_(HS####) or (JEDEC #) OR (CC####)(DL)                                                             |                            |
| Quad Leadless Ceramic Chip Carrier                                          | <b>LCC</b> (body_width) <b>X</b> (body_length)_(Pin_qty)(DL)                                                                                                                |                            |
| Quad Leadless Ceramic Chip Carrier<br>(Pin 1 on the Side)                   | <b>LCSS</b> (body_width) <b>X</b> (body_length)_(Pin_qty)(DL)                                                                                                               |                            |
| Quad Bottom Chip Carrier                                                    | <b>QBCC</b> (body_width) <b>X</b> (body_length)_(Pin_qty)(DL)                                                                                                               |                            |
| Resistor, Chip                                                              | <b>RESC</b> (body size)(DL) chip parts >9.99mm in either x or y will have 4 digit body size dimensions for both x and y using X as a separator i.e (9.14x10.20 = 9140X1020) | <b>_IS</b> (body_size_ths) |
| Resistor, Chip, Array                                                       | <b>RESAS</b> (Pin_qty) _(mfr_sern)_(Pin_qty) (DL)                                                                                                                           |                            |
| Resistor, Molded                                                            | <b>RESM</b> (body size)(DL)                                                                                                                                                 |                            |
| Resistor, MELF                                                              | <b>RESMELF</b> (body size)(DL)                                                                                                                                              |                            |
| Small Outline IC, J-Leaded                                                  | <b>SOJ</b> (pitch) <b>P</b> (Lead Span)_(Pin_qty) <b>D</b> (body_length)(DL)                                                                                                |                            |
| Small Outline Integrated Circuit<br>1.27mm Pitch, (Standard SOIC)           | <b>SOIC</b> (pitch) <b>P</b> (Lead Span)_(Pin_qty) <b>D</b> (body_length)(DL)                                                                                               |                            |
| Small Outline Package (Non-Standard SOICs)<br>> .50mm pitch, > 1.6mm height | <b>SOP</b> (pitch) <b>P</b> (Lead Span)_(Pin_qty) <b>D</b> (body_length)(DL)                                                                                                |                            |
| Small Outline Diode                                                         | <b>SOD</b> (Lead Span)(body_width)(DL)                                                                                                                                      |                            |
| Small Outline Narrow Dual No Lead Package                                   | <b>SON</b> (pitch) <b>P</b> _(body_width) <b>X</b> (body_length)_(Pin_qty)[Thermal_pad] or (mfr_pkgn) or (mfr_prtn) (DL) or (JEDEC #)                                       |                            |
| Small Outline Transistor Package<br>(JEDEC Standard Package)                | <b>SOT</b> (JEDEC #)[R](DL)                                                                                                                                                 |                            |
| Small Outline Transistor Package<br>(Generic Package)                       | <b>SOT</b> (pitch) <b>P</b> (Lead Span)_(Pin_qty)(DL)                                                                                                                       |                            |
| Transistor Single Outline Package<br>(Generic DPAK)                         | <b>TO</b> (pitch) <b>P</b> (Lead Span)_(Pin_qty) <b>D</b> (body_length) (DL)                                                                                                |                            |

Figure 7.3 IPC Naming Convention

## • Naming Convention Non IPC table

| Description / Category                                 | IPC Land pattern Name                                                                                                                                  | Notes                                      |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Capacitor, SMD                                         | <b>CAPS</b> (Pin_qty)_(mfr)_(mfr_pkgn)or(mfr_sern)or (mfr_prtn)(DL)                                                                                    | For any non-chip/non-molded SMD capacitors |
| Capacitor, Through_hole                                | <b>CAPT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn) or<br><b>CAPT</b> (Pin_qty)_(pitch) <b>P</b> (body_widthXlength)_PD(PinDia)              |                                            |
| Capacitor, Aluminum Electrolytic, Through_hole, Axial  | <b>CAPAETA</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn) or<br><b>CAPAETA</b> (Pin_qty)_(pitch) <b>P</b> (body_widthXlength)                   |                                            |
| Capacitor, Aluminum Electrolytic, Through_hole, Radial | <b>CAPAETR</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn) or<br><b>CAPAETR</b> (Pin_qty)_(pitch) <b>P</b> (body_widthXbody_height)              |                                            |
| Capacitor, Variable, SMD                               | <b>CAPVS</b> (Pin_qty)_(mfr)_(mfr_pkgn)or(mfr_sern)or (mfr_prtn)(DL)                                                                                   |                                            |
| Capacitor, Variable, Through_hole                      | <b>CAPVT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                                         |                                            |
| Connector, SMD                                         | (mfr)_(mfr_pn)                                                                                                                                         |                                            |
| Connector, Through_hole                                | (mfr)_(mfr_pn)                                                                                                                                         |                                            |
| Connector, Edge Fingers                                | <b>CFIN</b> _(standrd)_(Pin_qty)_(arbq)pitch, bits, volt lanes etc_(arb#) or<br><b>CFIN</b> (Pin_qty)_(pitch)_(arb#) or<br><b>CFIN</b> _(mfr)_(mfr_pn) |                                            |
| Connector, Terminal Strip Header , SMD                 | <b>CTSS</b> (pitch) <b>P</b> (rows)(angle)(Pin_qty)                                                                                                    |                                            |
| Connector, Terminal Strip Header , Through_hole        | <b>CTST</b> (pitch) <b>P</b> (rows)(angle)(Pin_qty)                                                                                                    |                                            |
| Battery, SMD                                           | <b>BATS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                                                      | <b>BATHS</b> = BatteryHolder SMD           |
| Battery, Through_hole                                  | <b>BATT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                                          | <b>BATHT</b> = BatteryHolder Through Hole  |
| Bridge Rectifier, SMD                                  | <b>BRIDGS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                                                    |                                            |
| Bridge Rectifier, Through_hole                         | <b>BRIDGT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                                        |                                            |
| Crystal, SMD                                           | <b>XTALS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                                                     | Make to manuf. Spec when possible.         |
| Crystal, Through_hole                                  | <b>XTALT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                                         |                                            |
| Diode, SMD                                             | <b>DIOS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                                                      | For any non-molded/non-melf SMD diodes     |
| Diode, Through_hole                                    | <b>DIOT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                                          |                                            |
| Diode, Array SMD                                       | <b>DIOAS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                                                     |                                            |
| Diode, Array Through_hole                              | <b>DIOAT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                                         |                                            |

| Description / Category                                     | IPC Land pattern Name                                                                                                            | Notes                                                                                                                      |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Filter, SMD                                                | <b>FILS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                                |                                                                                                                            |
| Filter, Through_hole                                       | <b>FILT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                    |                                                                                                                            |
| Fuse, SMD                                                  | <b>FUSS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                                | <b>FUSHS</b> = FuseHolder SMD                                                                                              |
| Fuse, Through_hole                                         | <b>FUST</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                    | <b>FUSHT</b> = FuseHolder Through Hole.                                                                                    |
| IC, Dip (body width inside lead leadspan)                  | <b>DIP</b> (pitch) <b>P</b> (Lead Span)_(Pin_qty) _ <b>D</b> (body_length)                                                       |                                                                                                                            |
| IC, Dip (body width outside lead leadspan) i.e sockets etc | <b>DIP</b> (pitch) <b>P</b> (Lead Span)_(Pin_qty)_(body_widthXlength)                                                            | _SKT                                                                                                                       |
| IC, MISC                                                   | (mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                                                      |                                                                                                                            |
| Inductor, SMD                                              | <b>INDS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                                | For any non-chip/non-molded SMD inductors                                                                                  |
| Inductor, SMD, power inductor                              | <b>INDS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)Q                                                                   | All power inductors will match the mfg. recommended land pattern.                                                          |
| Inductor, Through_hole                                     | <b>INDT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                    |                                                                                                                            |
| LED, SMD                                                   | <b>LEDS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL) or <b>LEDS</b> (Pin_qty)_(body size)_(mfr)_(DL)                | Body size convention may be used for chip type LEDs                                                                        |
| LED, Through_hole                                          | <b>LEDT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn) or <b>LEDT</b> (Pin_qty)_(pitch) <b>P</b> (body_widthXbody_height) |                                                                                                                            |
| Mechanical                                                 | <b>MEC</b> (mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                                               |                                                                                                                            |
| Miscellaneous, SMD                                         | <b>PARTTYPES</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)                                                           | <b>PARTTYPE</b> = obvious part type abbreviation                                                                           |
| Miscellaneous, Through_hole                                | <b>PARTTYPET</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)                                                               | <b>PARTTYPE</b> = obvious part type abbreviation                                                                           |
| Module, SMD                                                | <b>MODS</b> (mfr)_(mfr_sern)_(CC####) or (mfr_prtn)_(Pin_qty)(DL)                                                                |                                                                                                                            |
| Module, Through_hole                                       | <b>MODT</b> (mfr)_(mfr_sern)_(CC####) or (mfr_prtn)_(Pin_qty)                                                                    |                                                                                                                            |
| Mounting hole plated Metric                                | <b>Mx###D###P</b> _Suff<br>where x### = pad shape and size , D### = drill size<br>x = C for CIRCLE, S for SQUARE, B for OBLONG   | .01mm resolution<br>Suff = SSM### for specified solder mask<br>Various other suffixes may be used                          |
| Mounting hole non plated Metric                            | <b>Mx###D###N</b> _Suff<br>where x### = pad shape and size , D### = drill size<br>x = C for CIRCLE, S for SQUARE, B for OBLONG   | .01mm resolution<br>Suff = OBS### for built in route obstructs or<br>SSM### for specified mask, other suffixes may be used |
| Mounting hole plated Imperial                              | <b>MxI###D###P</b> _Suff<br>where x### = pad shape and size , D### = drill size<br>x = C for CIRCLE, S for SQUARE, B for OBLONG  | .001 inch resolution<br>Suff = SSM### for specified solder mask<br>Various other suffixes may be used                      |

| Description / Category                | IPC Land pattern Name                                                                                                           | Notes                                                                                                                                 |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Mounting hole non plated Imperial     | <b>MxI###D###N</b> _Suff<br>where x### = pad shape and size , D### = drill size<br>x = C for CIRCLE, S for SQUARE, B for OBLONG | .001 inch resolution<br>Suff = OBS### for built in route obstructs or<br>SSM### for specified mask Various other suffixes may be used |
| Oscillator, SMD                       | <b>OSCS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)(DL)                                                                | Made to manuf. Spec when possible.                                                                                                    |
| Oscillator, Through_hole              | <b>OSCLT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                   |                                                                                                                                       |
| Resistor, SMD                         | <b>RESS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)(DL)                                                                | For any non-chip/non-molded SMD resistors                                                                                             |
| Resistor, Through_hole Mfr specific   | <b>REST</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                    |                                                                                                                                       |
| Resistor, Through_hole Generic Axial  | <b>RESTA</b> (Pin_qty) <b>P</b> (body_widthXlength)                                                                             |                                                                                                                                       |
| Resistor, Through_hole Generic Radial | <b>RESTR</b> (Pin_qty) <b>P</b> (body_widthXlength)                                                                             |                                                                                                                                       |
| Resistor Pack, SMD                    | <b>RESAS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)(DL)                                                               |                                                                                                                                       |
| Resistor Pack, Through_hole           | <b>RESAT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                   |                                                                                                                                       |
| Resistor Pack, Through_hole Generic   | <b>RESAT</b> (Pin_qty) <b>P</b> (body_widthXlength)                                                                             |                                                                                                                                       |
| Resistor, Pot SMD                     | <b>RESPS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)(DL)                                                               |                                                                                                                                       |
| Resistor, Pot Through_hole            | <b>RESPT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                   |                                                                                                                                       |
| Relay, SMD                            | <b>RLYS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)(DL)                                                                | <b>RLYSS</b> = Relay Socket SMD                                                                                                       |
| Relay, Through_hole                   | <b>RLYT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                    | <b>RLYST</b> = Relay Socket Through Hole                                                                                              |
| Sensor, SMD                           | <b>SENS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                    |                                                                                                                                       |
| Sensor, Through_hole                  | <b>SENT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                    |                                                                                                                                       |
| Speaker, SMD                          | <b>SPKS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)(DL)                                                                |                                                                                                                                       |
| Speaker, Through_hole                 | <b>SPKT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                    |                                                                                                                                       |
| Switch, DIP, SMD                      | <b>SWDPS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)(DL)                                                               |                                                                                                                                       |
| Switch, DIP, Through_hole             | <b>SWDPT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                   |                                                                                                                                       |
| Switch, Push, SMD                     | <b>SWPBS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)(DL)                                                               |                                                                                                                                       |
| Switch, Push, Through_hole            | <b>SWPBT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)                                                                   |                                                                                                                                       |
| Switch, Rotary, SMD                   | <b>SWRTS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC###) or (mfr_prtn)(DL)                                                               |                                                                                                                                       |

| Description / Category                                    | IPC Land pattern Name                                              | Notes                                                                         |
|-----------------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Switch, Rotary, Through_hole                              | <b>SWRTT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)     |                                                                               |
| Switch, Slide, SMD                                        | <b>SWSLS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL) |                                                                               |
| Switch, Slide, Through_hole                               | <b>SWSLT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)     |                                                                               |
| Switch, Toggle, SMD                                       | <b>SWTGS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL) |                                                                               |
| Switch, Toggle, Through_hole                              | <b>SWTGT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)     |                                                                               |
| Test point, Pad In Circuit Test                           | <b>ICT_TP_SMD</b> _(IMPERIAL#####X#####SHAPE)                      | Shape is RD round, SQ square, R rectangle<br>Name is in imperial units (thou) |
| Test point, Pad SMD Imperial                              | <b>TPIS</b> _(#####X#####PAD)                                      | .001 inch resolution                                                          |
| Test point, Pad Through_hole Imperial                     | <b>TPIT</b> _(#####DRL_#####PAD)                                   | .001 inch resolution                                                          |
| Test point, Pad SMD Metric                                | <b>TPMS</b> _(#####X#####PAD)                                      | .01mm resolution                                                              |
| Test point, Pad Through_hole Metric                       | <b>TPMT</b> _(#####DRL_#####PAD)                                   | .01mm resolution                                                              |
| Test point, Part SMD                                      | <b>TPS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)   |                                                                               |
| Test point, Part Through_hole                             | <b>TPT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)       |                                                                               |
| Thermistor, SMD                                           | <b>THR</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)   |                                                                               |
| Thermistor, Through_hole                                  | <b>THR</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)       |                                                                               |
| Transformer, SMD                                          | <b>XFMRS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL) |                                                                               |
| Transformer, Through_hole                                 | <b>XFMRT</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)     |                                                                               |
| Transient voltage suppressor (transzorb),SMD              | <b>TVSS</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)  |                                                                               |
| Transient voltage suppressor (transzorb),<br>Through_hole | <b>TVST</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)      |                                                                               |
| Varistor, SMD                                             | <b>VAR</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)(DL)   |                                                                               |
| Varistor, Through_hole                                    | <b>VAR</b> (Pin_qty)_(mfr)_(mfr_sern)_(CC####) or (mfr_prtn)       |                                                                               |
| Arbitrary                                                 | <b>(mfr)_(CC##)</b>                                                |                                                                               |

Figure 7.4 Non IPC Naming Convention

## • Naming Convention Codes

| CODE                          | Definition                                                                  | # of Characters                                                                                                                                                                                                                                                 |
|-------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (#_of_pin_col)                | # of pin columns                                                            | Max 3 characters, min 1 character                                                                                                                                                                                                                               |
| (#_of_pin_rows)               | # of pin rows                                                               | Max 3 characters, min 1 character                                                                                                                                                                                                                               |
| (angle)                       | Straight - S or Right Angle - R                                             | 1 Character                                                                                                                                                                                                                                                     |
| (arb#)                        | Arbitrary number to distinguish mech named similar parts where required     | Up to 31 characters in the name                                                                                                                                                                                                                                 |
| (arbq)                        | Arbitrary qualifiers can be anything that makes sense                       | Up to 31 characters in the name                                                                                                                                                                                                                                 |
| (body_length)                 | in metric – 11.27mm = 1127                                                  | Max 4 char, min 3 characters, .01 resolution                                                                                                                                                                                                                    |
| (body_size)                   | body size in metric, 0603                                                   | 4 characters                                                                                                                                                                                                                                                    |
| (body_size_ths)               | body size in thousandths, 0201                                              | 4 characters                                                                                                                                                                                                                                                    |
| (body_widthXbody_height)      | in metric – 11.27mm = 1127                                                  | Max 4X4 char, min 2X2 characters, .01 resolution, median dimensions                                                                                                                                                                                             |
| (body_widthXlength)           | in metric – 11.27mm = 1127                                                  | Max 4X4 char, min 2X2 characters, .01 resolution, median dimensions                                                                                                                                                                                             |
| (density)                     | STD standard or HD high density                                             | Max 3 characters, min 2 character                                                                                                                                                                                                                               |
| (DL)                          | Density Level, M= Maximum, N= nominal, L= Least, Q = Manufacturer Specified | 1 Character. If a surface mount device does not have a density level, assume a density level of Q. Through hole devices and devices that require additional land pattern requirements do not have a density level and are assumed to have a density level of Q. |
| (ibody_widthXibody_height)    | in imperial – 0.100inch = 100                                               | Max 4X4 char, min 2X2 characters, .001 resolution                                                                                                                                                                                                               |
| (ibody_widthXilength)         | in imperial – 0.100inch = 100                                               | Max 4X4 char, min 2X2 characters, .001 resolution                                                                                                                                                                                                               |
| (iLead Span) “edge to edge”   | in imperial – 0.100inch = 100, 0.050inch pitch = 50                         | Max 4 characters, min 2 characters, .001 resolution                                                                                                                                                                                                             |
| (ipitch) “pin to pin spacing” | in imperial – 0.100inch = 100, 0.050inch pitch = 50                         | Max 4 characters, min 2 characters, .001 resolution                                                                                                                                                                                                             |
| (jedec)                       | Jedec package code                                                          | various                                                                                                                                                                                                                                                         |
| (m/f)                         | Male or female                                                              | 1 Character                                                                                                                                                                                                                                                     |
| (mtg_qty)                     | # of mtgholes                                                               | Max 2 characters, min 1 character                                                                                                                                                                                                                               |
| (Pin_qty)                     | # of pins                                                                   | Max 3 characters, min 1 character                                                                                                                                                                                                                               |
| (pitch) “pin to pin spacing”  | in metric – 1.27mm = 127, .80mm pitch = 80                                  | Max 4 characters, min 2 characters, .01 resolution                                                                                                                                                                                                              |

| CODE         | Definition                                                                                                           | # of Characters                                    |
|--------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| (ra pin t2h) | Distance from pin tip to cell origin (pin1 on thp, center of pads on smd) in metric – 1.27mm = 127, .80mm pitch = 80 | Max 4 characters, min 2 characters, .01 resolution |
| (rows)       | # of rows – S single D dual T triple Q quad                                                                          | Max 1 characters, min 1 character                  |
| (st or rt)   | Straight (st) or Right Angle (rt)                                                                                    | 2 Characters                                       |
| (standard)   | Industry standard – PCI, ISA, DIMM etc                                                                               | Up to 31 characters in the name                    |
| (HS####)     | Head Sink thermal pad dims                                                                                           | Up to 31 characters in the name                    |
| (z or blank) | Z = zig zag pad pattern , otherwise leave blank                                                                      | Max 1 characters, min 0 character                  |

*Figure 7.5 Naming Convention Codes*

## Default Settings

| NAME                             | DESCRIPTION                                                                                                                                                                                                                                                                                                              | Value   |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Assembly Outline Width.          | Outline that represents the body outline of the part.                                                                                                                                                                                                                                                                    | 0.1     |
| Land pattern Round off factor    | Standard land patterns will be rounded to the nearest.                                                                                                                                                                                                                                                                   | 0.05    |
| Maximum Land pattern Name Length |                                                                                                                                                                                                                                                                                                                          | 31 Chrs |
| Maximum Padstack Name Length     |                                                                                                                                                                                                                                                                                                                          | 31 Chrs |
| Minimum Pad to Pad Gap           |                                                                                                                                                                                                                                                                                                                          | 0.20    |
| Minimum Silkscreen Length        |                                                                                                                                                                                                                                                                                                                          | 0.35    |
| Minimum Soldermask Width         |                                                                                                                                                                                                                                                                                                                          | 0.08    |
| Part Number                      | Height: 0.5mm, Stroke Width: 0.1mm.<br>Placement: Same as Reference Designator (Assy).                                                                                                                                                                                                                                   |         |
| Pin Numbering                    | All pins, including plated through holes, will have a pin number, unless specified by the customer. No two pins will have the same pin number. Additional pins are assigned the next numerical number if a pin number is not provided. Fiducials will be defaulted as mechanical pins and will not require a pin number. |         |
| Placement Outline                | Shape that represents the body and pins of the part.                                                                                                                                                                                                                                                                     | 0       |
| Reference Designator (Assy)      | Height: 1mm, Stroke Width: 0.1mm.                                                                                                                                                                                                                                                                                        |         |
| Reference Designator (Silk)      | Height: 0.9mm, Stroke Width: 0.13mm.<br>Placement: Outside the body so it is visible when the component is placed.                                                                                                                                                                                                       |         |
| Silkscreen Gap                   | The minimum gap required between the silkscreen and any land pattern.                                                                                                                                                                                                                                                    | 0.13    |
| Silkscreen Outline Width         | Outline that represents the body outline of the part.<br>Does not cover any land pattern.                                                                                                                                                                                                                                | 0.13    |
| Units                            | The land pattern and pads and padstacks will be drawn in millimeters.                                                                                                                                                                                                                                                    |         |

Figure 7.6 Default Settings

## Glossary

The following terms and definitions used herein are to reduce confusion in the terminology across different tools, manufacturers, and other documentation.

**Dual row component** – A component where the basic land pattern consists of two rows of lands.

**Land or Padstack** – A single conductive element of a component placed on a printed circuit/wiring board. This can consist of a pad, pastemask, and soldermask.

**Heel** – The edge of a single land or component termination that is closest to the center of a component.

**Heel to heel (H/H)** – The distance between two opposing heels or component terminations in a single component.

**Land Pattern** – The complete physical pattern of a component placed on a printed circuit/wiring board. This can consist of lands, silkscreen outlines, assembly outlines, placement outlines, courtyard outlines, drills, and keepout outlines.

**Pad** – the conductive part of a land pattern.

**Quad component** – A component where the basic land pattern consists of two rows and two columns of lands.

**Single row component** – A component where the basic land pattern consists of a single row of lands.

**Termination** – a pin, leg, or contact of a component.

**Toe** – The edge of a single land or component termination that is farthest away from the center of a component.

**Toe to toe (T/T)** – The distance between two opposing toes or component terminations in a single component.

## Generic Components

Many resistors capacitors and inductors are included in the library in generic form, meaning they have no manufacturer part numbers.