CadPack

Import from Protel

Software Tool for import from Protel Cad format

Technical Info

Version : 2
Code : 81190414.112

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Contents

Introduction

CAD files are the base for the automatic generation of test program for InCircuit of any technology.

Both Bed of Nails and Flying Probe testers, require the circuit information available on CAD format, in order to generate the ICT test program in a short time and without errors.

The Import from Protel CAD import driver enables to import data present in the Protel CAD file and convert them in the SPEA Board data format.

Conventions, symbols and abbreviations

In the document, the ⓘ symbol is used to highlight information or notes useful to the reader.

This manual can be updated in accordance with the evolution of the system and associated software.
It may contain preliminary contents or it may not be entirely updated with the latest versions used in the system.

Any remarks on errors and imperfections, or suggestions, can be addressed to:

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1. Protel file data

With the “PROTEL CAD files” words we refer to the output information generated by the PROTEL CAD-CAE programs for the electrical diagrams design and PCB development, used to develop a test application (test program and adapter design).

Information stored in the “PROTEL CAD files” concern an electronic board and can be used by an appropriate program to generate a test program and its test adapter design (Bed of Nails or list of movement for Flying Probes).

Information can be grouped in 4 different categories and typically concern the printed circuit:

Part List
It is the list of all used devices, it must contain: devices drawing reference, part numbers, value, tolerances, device type, etc.
Net List
It is also called wiring list, containing device interconnection data; basically it is a presentation of the electrical diagram.
Coordinate and access list
It is the list containing the devices coordinates, concerning their barycentre and pins.
Wiring and Routing list
It is the list containing the path of the Net tracks in the PCB.

For the import of the information above mentioned, SPEA has developed the specific program for the translation, stored in a specified format, to its common data bank called “Board Data”.
The name of this type of program is “CAD import driver”.

For the required information, see the list in the following paragraphs.

1.1 Part List

The Part List is an ASCII text file, containing the list of all the parts used to assemble the board; sometimes it can be called **Bill of Material** (BOM).

In the Part List all information concerning the mounted and not mounted parts must be present.
For every part the following information must be defined:

Information	Description
Drawing Reference	Reference designator (e.g. U10, R105, D23, etc.).
Part Number	Device code (e.g. 132549.012, C4QW08, 001-58-AA, etc.).
Value	Device value (e.g. 10KΩ, 10µF, 1mH, etc.).
Tolerance	Positive and negative device tolerances (e.g. 1%, 5%, etc.).
Mounting side	The legal values for this item can be: - **Top** (Component side) - **Bottom** (Soldering side) - **Not mounted Top** - **Not mounted Bottom**
Rotation [1]	Device mounting rotation angle (e.g. 0°, 180°, etc.).
Dimensions [1]	Device dimensions.
Case code [1]	Device package (case) code.

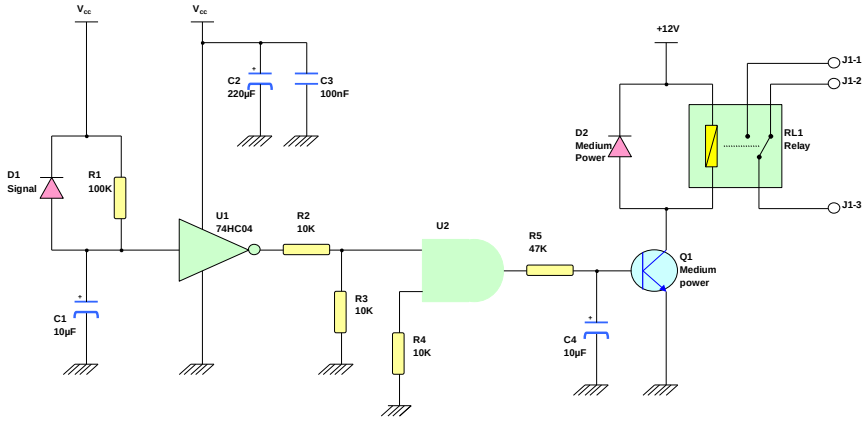
[1] **Optional data (not yet managed)**

1.2 Net List

The Net List is an ASCII text file containing the device interconnection data; it is also called wiring list.
This list must contain the interconnection between devices, including pad and via.
Basically, it is the representation of the electrical diagrams.

For every net the following information must be defined:

Information	Description
Net name	Net identifier (e.g. +5V, RESET, A01, etc.).
Drawing reference	Reference designator of the device connected to the net (e.g. U10, R105, D23, etc.).
Pin name	Name of the device pin connected to the net (e.g. 1, 15, Anode, K, Negative, etc.).
Pin access side	Access side for the device pin, legal values are: - **Top** (Device side access). - **Bottom** (Soldering side access). - **Not accessible** - **All** (both top and bottom side access)



1.3 Coordinates and access list

The Coordinates and access list is an ASCII text file containing the devices coordinates concerning their barycentre and pins. Below, the required information:

Information	Description
Drawing Reference	Reference designator of the device connected to the net (e.g. U10, R105, D23, etc.).
Pin name	Name of the device pin connected to the net (e.g. 1, 15, Anode, K, Negative, etc.).
Pin X position	Pin X-coordinate.
Pin Y position	Pin Y-coordinate.
X barycentre [1]	Device X barycentre.
Y barycentre [1]	Device Y barycentre.

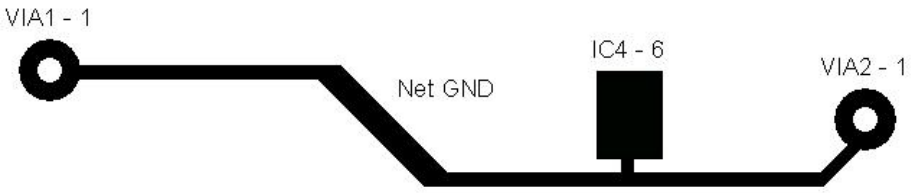
1.4 Wiring and Routing list

The Wiring and Routing list is an ASCII text file that contains all the coordinates of the Net tracks on the PCB and the link with the Net List. So the path of each net on the PCB is described in this file.

For every net the following information must be defined:

Information	Description
Net name	Net identifier (e.g. +5V, RESET, A01, etc.).
X Start	Track segment start X-coordinate.
Y Start	Track segment start Y-coordinate.
X End	Track segment end X-coordinate.
Y End	Track segment end Y-coordinate.
Width	Net segment thickness.
Layer	Layer the segment belongs to.

Example:



[1] **Optional data**

2. Protel file generalities

2.1 Protel file name

The Protel files have the extensions: **.CSV**, **.HYP**, **.PIK**
They are ASCII text files and contain information concerning the board, device and their connections.

2.2 Export file generation

The.HYP file can be generated inside Protel under: FILE - EXPORT - HYPERLYNX.

2.3 Protel file conversion from Unix to MS-DOS

When the diagram entry has been performed and checked on the Protel CAD workstation, the Protel files should be made available for the SPEA system.

The SPEA system is based on a PC platform operating in a Windows® environment, this means that the CAD import driver can manage ASCII Text file in MS-DOS format.

In order to perform the conversion, please refer to appendix A – **Note about the Protel ASCII text file format**.

3. Protel file format

This is a partial extract of an example of the Protel output ASCII text files:

Demo.CSV

```
"Part Type","Designator","Footprint","Description","Library Field 1","Library Field 2","Library Field 3","Library Field 4","Library Field 5","Library Field 6","Library Field
7","Library Field 8","Part Field 1","Part Field 2","Part Field 3","Part Field 4","Part Field 5","Part Field 6","Part Field 7","Part Field 8","Part Field 9","Part Field 10","Part Field
11","Part Field 12","Part Field 13","Part Field 14","Part Field 15","Part Field 16"
"0R","R43","L23805","4.715000 0R 5% 0805 R-Chip","4.715000","","0805","L23805","","","+5%","-5%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"100K","R41","L23805","4.715104 100K 1% 0805 R-Chip","4.715104","","0805","L23805","","","+1%","-1%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"100K","R63","L23805","4.715104 100K 1% 0805 R-Chip","4.715104","","0805","L23805","","","+1%","-1%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*"
"100K","R42","L23805","4.715104 100K 1% 0805 R-Chip","4.715104","","0805","L23805","","","+1%","-1%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"100K","R40","L23805","4.715104 100K 1% 0805 R-Chip","4.715104","","0805","L23805","","","+1%","-1%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"100N","C5","L23805","4.862104 Chip 100N 0805 20%","4.862104","","0805","L23805","","","+20%","-20%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL02"
"100N","C4","L23805","4.862104 Chip 100N 0805 20%","4.862104","","0805","L23805","","","+20%","-20%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL02"
"100N","C49","L23805","4.862104 Chip 100N 0805 20%","4.862104","","0805","L23805","","","+20%","-20%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL04"
"74HC00","U10","L25214","4.645000 74HC00 SMD SO-14","4.645000","","SO-14","L25214","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*"
"74HC4053","U7","L25216","4.645047 74HC4053  SMD  SO-16","4.645047","","SO-16","L25216","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"AD7705BR","U3","L25316","4.625099 AD7705  SMD  SO-16L","4.625099","","SO-16L","L25316","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL02"
"AMP-12/90","P4","L11035","4.265017 AMP-12/90 SMD","4.265017","","AMP-12/90","L11035","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"AT45D081-RC","U6","L25528","4.655158 AT45D081-RC SMD SO-28","4.655158","","SO-28","L25528","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"ATMEGA103","U5","L25565","4.655159 ATMEGA103 SMD QFP-64","4.655159","","QFP-64","L25565","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"BAT42","D10","L23007","4.665004 Diode TMMBAT42 SMD Minimelf","4.665004","","MELF 1206","L23007","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"BAT42","D12","L23007","4.665004 Diode TMMBAT42 SMD Minimelf","4.665004","","MELF 1206","L23007","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"BAT42","D4","L23007","4.665004 Diode TMMBAT42 SMD Minimelf","4.665004","","MELF 1206","L23007","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL02"
```

Demo.PIK

```
Designator","Pattern","Mid X","Mid Y","Ref X","Ref Y","Pad X","Pad Y","Layer","Rotation"
"K2","KOPFA4Q+30","0mil","0mil","12285mil","3640mil","0mil","0mil","T","360.00"
"TP72","L914","5600mil","7030mil","5600mil","7030mil","5600mil","7030mil","B","180.00"
"C51","L23507","5535mil","7285mil","5535mil","7285mil","5535mil","7400mil","T","270.00"
"S20","L10054PADOK","8115mil","7435mil","8115mil","7435mil","8195mil","7435mil","B","180.00"
"R49","L23006","5265mil","7270mil","5265mil","7270mil","5265mil","7333mil","T","90.00"
"R48","L23006","5360mil","7270mil","5360mil","7270mil","5360mil","7333mil","T","90.00"
"TP61","L914","5360mil","7130mil","5360mil","7130mil","5360mil","7130mil","B","180.00"
"U8","L10081","5185mil","6930mil","5185mil","6930mil","5185mil","7067.795mil","T","270.00"
"D11","L23007","8785mil","7400mil","8785mil","7400mil","8848mil","7400mil","T","360.00"
"D10","L23007","8785mil","7320mil","8785mil","7320mil","8848mil","7320mil","T","360.00"
```

Demo.HYP

```
{VERSION=2.14}

{UNITS=ENGLISH LENGTH}
.
.
{DEVICES
  (? REF=K2 L=Top_Layer)
  (? REF=C51 L=Top_Layer)
  (? REF=NU4 L=Top_Layer)
  (? REF=NC4 L=Top_Layer)
  (? REF=NC3 L=Top_Layer)
  (? REF=NU7 L=Top_Layer)
  (? REF=NC5 L=Top_Layer)
  (? REF=NC2 L=Top_Layer)
  (? REF=R49 L=Top_Layer)
  (? REF=TP48 L=Bottom_Layer)
  (? REF=TP148 L=Bottom_Layer)
  (? REF=TP71 L=Bottom_Layer)
  (? REF=TP22 L=Bottom_Layer)
  (? REF=TP40 L=Bottom_Layer)
  (? REF=TP150 L=Bottom_Layer)
  (? REF=TP2 L=Bottom_Layer)
  (? REF=TP3 L=Bottom_Layer)
}
{PADSTACK=0, 0.0000
  (Top_Layer, 1, 0.0240, 0.1000, 270.000, M)
}
{PADSTACK=1, 0.0000
  (Top_Layer, 0, 0.0590, 0.0590, 0, M)
}
{PADSTACK=2, 0.0000
  (Top_Layer, 1, 0.0270, 0.0390, 180.000, M)
}
{PADSTACK=3, 0.0000
  (Top_Layer, 1, 0.0560, 0.0400, 90.000, M)
}
.

{NET=N00165
  (SEG X1=5.1850 Y1=7.0284 X2=5.2316 Y2=7.0284 W=0.0080 L=Top_Layer)
  (SEG X1=5.2316 Y1=7.0284 X2=5.2881 Y2=7.0850 W=0.0080 L=Top_Layer)
  (SEG X1=5.2881 Y1=7.0850 X2=5.4850 Y2=7.0850 W=0.0080 L=Top_Layer)
  (SEG X1=5.4850 Y1=7.0850 X2=5.5400 Y2=7.0300 W=0.0080 L=Top_Layer)
  (SEG X1=5.5400 Y1=7.0300 X2=5.5600 Y2=7.0300 W=0.0080 L=Top_Layer)
  (SEG X1=5.5600 Y1=7.0300 X2=5.6000 Y2=7.0300 W=0.0080 L=Bottom_Layer)
  (VIA X=5.5600 Y=7.0300 P=58)
  (PIN X=5.1850 Y=7.0284 R=U8.2 P=0)
  (PIN X=5.6000 Y=7.0300 R=TP72.1 P=42)
}
{NET=N00143
  (SEG X1=9.4350 Y1=6.4580 X2=9.4350 Y2=6.5000 W=0.0320 L=Top_Layer)
  (SEG X1=9.3920 Y1=6.5430 X2=9.4350 Y2=6.5000 W=0.0320 L=Top_Layer)
  (SEG X1=9.2850 Y1=6.5430 X2=9.3920 Y2=6.5430 W=0.0320 L=Top_Layer)
  (SEG X1=9.4350 Y1=6.5000 X2=9.4350 Y2=6.5350 W=0.0080 L=Bottom_Layer)
  (VIA X=9.4350 Y=6.5000 P=58)
  (PIN X=9.2850 Y=6.5430 R=J2.1 P=39)
  (PIN X=9.4350 Y=6.4580 R=D6.1 P=10)
  (PIN X=9.4350 Y=6.5350 R=TP39.1 P=42)
}
```

The Import from Protel CAD driver can correctly identify and use the following sections:

- **Part list**
- **Net list**
- **Pin Coordinates**
- **Vias**

In the next paragraphs a short description for each section is provided.

3.1 Part list – CSV file data

This section contains the part list and bill of material data of each single device present in the Protel .**CSV** CAD file; data are separated by "," (comma).

Every single row of the Protel **.CSV** file, in this section, contains the following information:

1. **Value/Part name**
2. **Drawing reference**
3. Not used
4. Not used
5. **Part Number**
6. Not used
7. **Case/Package name**
8. Not used
9. Not used
10. Not used
11. **Tolerance positive**
12. **Tolerance negative**

The following example shows the syntax used for the **Part list** section in the .CSV file:

1	2	3	4	5	6	7	8 - 10	11	12	13 - n
Value/Part name	Drawing ref.	Not used	Not used	Part Number	Not used	Case/Package name	Not used	Tol+	Tol-	Not used
100K	R100			L23805		0805		5	5	

```
"Part Type","Designator","Footprint","Description","Library Field 1","Library Field 2","Library Field 3","Library Field 4","Library Field 5","Library Field 6","Library Field
7","Library Field 8","Part Field 1","Part Field 2","Part Field 3","Part Field 4","Part Field 5","Part Field 6","Part Field 7","Part Field 8","Part Field 9","Part Field 10","Part Field
11","Part Field 12","Part Field 13","Part Field 14","Part Field 15","Part Field 16"
"100K","R41","L23805","4.715104 100K 1% 0805 R-Chip","4.715104","","0805","L23805","","","+1%","-1%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"100K","R63","L23805","4.715104 100K 1% 0805 R-Chip","4.715104","","0805","L23805","","","+1%","-1%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*"
"100N","C23","L23805","4.862104 Chip 100N 0805 20%","4.862104","","0805","L23805","","","+20%","-20%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"100N","C31","L23805","4.862104 Chip 100N 0805 20%","4.862104","","0805","L23805","","","+20%","-20%","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*"
"74HC00","U10","L25214","4.645000 74HC00 SMD SO-14","4.645000","","SO-14","L25214","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*"
"74HC4053","U7","L25216","4.645047 74HC4053  SMD  SO-16","4.645047","","SO-16","L25216","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"AMP-12/90","P4","L11035","4.265017 AMP-12/90 SMD","4.265017","","AMP-12/90","L11035","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"AT45D081-RC","U6","L25528","4.655158 AT45D081-RC SMD SO-28","4.655158","","SO-28","L25528","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"BAT42","D10","L23007","4.665004 Diode TMMBAT42 SMD Minimelf","4.665004","","MELF 1206","L23007","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
"BAT42","D12","L23007","4.665004 Diode TMMBAT42 SMD Minimelf","4.665004","","MELF 1206","L23007","","","","","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","*","BL03"
```

3.2 Part list – PIK file data

This section basically contains the part list and mounting data of each single device present in the Protel **.PIK** CAD file; data are separated by "," (comma).

Every single row of the Protel **.PIK** file, in this section, contains the following information:

1. **Value/Part name**
2. **Drawing reference**
3. Not used
4. **X Barycenter**
5. **Y Barycenter**
6. Not used
7. Not used
8. Not used
9. Not used
10. **Mounting side**
11. **Rotate**

The following example shows the syntax used for the **Part list** section in the **.PIK** file:

1	2	3	4	5	6 - 8	9	10
Drawing ref.	Not used	Not used	X Batycenter	Y Batycenter	Not used	Mount side	Rotate
R10			7270	5265		T	90

```
"Designator","Pattern","Mid X","Mid Y","Ref X","Ref Y","Pad X","Pad Y","Layer","Rotation"
"R49","L23006","5265mil","7270mil","5265mil","7270mil","5265mil","7333mil","T","90.00"
"R48","L23006","5360mil","7270mil","5360mil","7270mil","5360mil","7333mil","T","90.00"
"TP61","L914","5360mil","7130mil","5360mil","7130mil","5360mil","7130mil","B","180.00"
"U8","L10081","5185mil","6930mil","5185mil","6930mil","5185mil","7067.795mil","T","270.00"
"C52","L23504","5355mil","6895mil","5355mil","6895mil","5355mil","6799mil","T","270.00"
"C49","L23805","5465mil","6840mil","5465mil","6840mil","5465mil","6800mil","T","360.00"
"D2","L23001","11020mil","7720mil","11020mil","7720mil","10939.723mil","7663.789mil","T","90.00"
"TP69","L914","7606mil","6180mil","7606mil","6180mil","7606mil","6180mil","B","180.00"
"TP85","L914","7590mil","6395mil","7590mil","6395mil","7590mil","6395mil","B","180.00"
"U3","L25316","6200mil","5925mil","6200mil","5925mil","6375mil","6115mil","T","180.00"
```

3.3 Net list, Pins and Vias coordinates – HYP file data

This section is used to describe the device pin properties (Pin name, Net name, Drawing reference); data are separated by "!" in a row of the Protel file.

The "Import from Protel" import CAD driver manages the following data:

- **Net name**
- **Drawing reference**
- **Pin name**
- **Pin X/Y coordinate**
- **Via X/Y coordinate**

```
{NET=N00165                                                          Net name
   (SEG X1=5.1850 Y1=7.0284 X2=5.2316 Y2=7.0284 W=0.0080 L=Top_Layer)
   (SEG X1=5.2316 Y1=7.0284 X2=5.2881 Y2=7.0850 W=0.0080 L=Top_Layer)
   (SEG X1=5.2881 Y1=7.0850 X2=5.4850 Y2=7.0850 W=0.0080 L=Top_Layer)
   (SEG X1=5.4850 Y1=7.0850 X2=5.5400 Y2=7.0300 W=0.0080 L=Top_Layer)
   (SEG X1=5.5400 Y1=7.0300 X2=5.5600 Y2=7.0300 W=0.0080 L=Top_Layer)
   (SEG X1=5.5600 Y1=7.0300 X2=5.6000 Y2=7.0300 W=0.0080 L=Bottom_Layer)
   (VIA X=5.5600 Y=7.0300 P=58)
   (PIN X=5.1850 Y=7.0284 R=U8.2 P=0)
   (PIN X=5.6000 Y=7.0300 R=TP72.1 P=42)
}
{NET=N00143                                                          Net name
   (SEG X1=9.4350 Y1=6.4580 X2=9.4350 Y2=6.5000 W=0.0320 L=Top_Layer)
   (SEG X1=9.3920 Y1=6.5430 X2=9.4350 Y2=6.5000 W=0.0320 L=Top_Layer)
   (SEG X1=9.2850 Y1=6.5430 X2=9.3920 Y2=6.5430 W=0.0320 L=Top_Layer)
   (SEG X1=9.4350 Y1=6.5000 X2=9.4350 Y2=6.5350 W=0.0080 L=Bottom_Layer)
   (VIA X=9.4350 Y=6.5000 P=58)
   (PIN X=9.2850 Y=6.5430 R=J2.1 P=39)
   (PIN X=9.4350 Y=6.4580 R=D6.1 P=10)
   (PIN X=9.4350 Y=6.5350 R=TP39.1 P=42)
}
```

The following example shows the syntax used for the **SEG** identifier:

	Start X-coord.	Start Y-coord.	End X-coord.	End Y-coord.	Width	Layer number
SEG	X1=5.2316	Y1=7.0284	X2=5.2881	Y2=7.0850	W=0.0080	L=Top_Layer

The following example shows the syntax used for the **VIA** identifier:

	X-coord.	Y-coord.
VIA	X=5.5600	Y=7.0300

The following example shows the syntax used for the **PIN** identifier:

	X-coord.	Y-coord.	Drawing ref.	Pin name
PIN	X=5.6000	Y=7.0300	R=TP72	1

4. Import setting

4.1 Pin function assignment

This assignment table must be filled, in order to correctly execute the CAD file import.

In order to correctly test some polarized devices such as diodes, bipolar transistors, etc., it is basic to identify correctly the pin function (i.e. anode, base, etc.) of each pin.

The fields contained in the table, are described below:

Field	Description
Device Type	Identifies the type of device (example: Resistors, Capacitors, Digital Devices, Diodes etc.).
Pin Function	Function concerning the Pin.
Pin Name	Pin reference.
Cad Pin	Pin reference in Cad file.

4.2 Drawing ref. initials/device type assignment

The Protel file typically contains all information about the devices, such as value, tolerances and type; which are fundamental from the point of view of the test program generation.

The fields contained in the table are described below:

Field	Description
Drawing Reference	Initial letter identifying the **Device Type**.
Device Type	Identifies the type of device (example: Resistors, Capacitors, Digital Devices, Diodes etc.).
Default Tol+, Tol-	Value and tolerance of the device only if required (as for resistors).

I t could happen that in the CAD file they are missing. For each drawing reference initial, the displayed table enables to define the following data default values:

Device type

- Default positive tolerance
- Default negative tolerance

This means that if, for any reason, the CAD file does not contain the information mentioned above, the default values will be used.

A. Note about the Protel ASCII text file format

The Protel CAD-CAE typically runs under Unix operating system and generates its neutral ASCII output file in Unix format.

The Unix ASCII text files use he "$0a_{hex}$"ASCII character as end of line identifier.
The Windows® (MS-DOS) operating system uses the "$0d_{hex}$" and "$0a_{hex}$" ASCII characters as end of line identifiers for ASCII text files.
This means that output ASCII text files may require an ASCII format conversion (from Unix to Windows® format).

This operation can be performed using "WordPad", a standard text file editor.
Open the Protel ASCII file with this editor and save it, this operation will automatically perform the conversion from ASCII Unix format to ASCII Windows® format.