CadPack

Import from Cadence

Software tool for import from Cadence Cad format

Technical Info

Version : 2
Code : 81190401.081

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Contents

Introduction

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

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

The Import from Cadence CAD import driver enables to import data present in Cadence CAD file and to convert them in 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. Cadence file data

With the “Cadence CAD files” words we refer to the output information generated by the Cadence 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 “Cadence 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 movements 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 mentioned above, SPEA has developed the specific program for the translation stored in a specified format into its 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	Device mounting rotation angle (e.g. 0°, 180°, etc.).
Dimensions [1]	Device dimensions.
Case code	Device package (case) code.

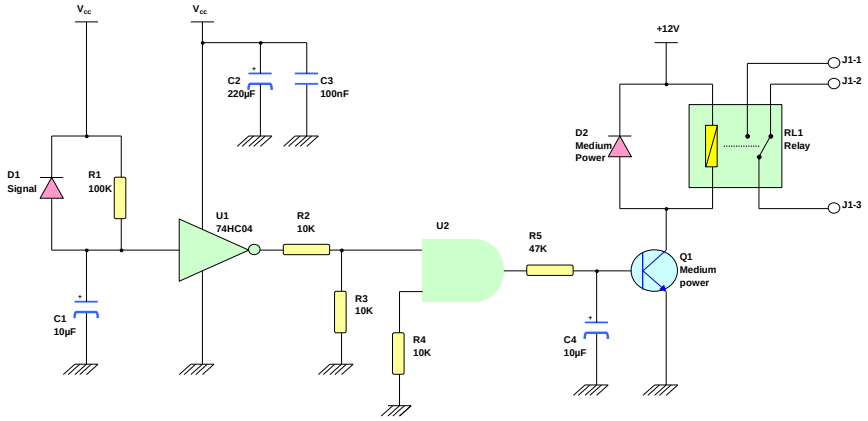
[1] **Optional data (not yet managed)**

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 sides 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.

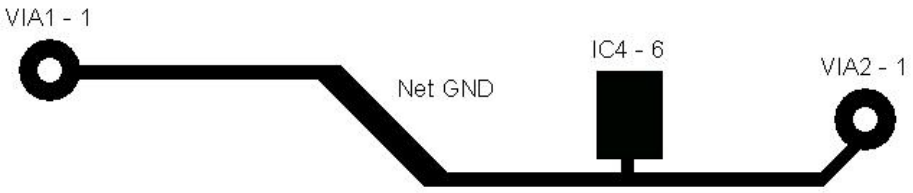
1.4 Wiring and Routing list

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. Cadence file generalities

2.1 Cadence file name

The Cadence Neutral file name has to have the **.FAB** extension.
It is an ASCII text file and it contains the information related to the board, device and their connections.

2.2 Cadence file conversion from Unix to MS-DOS

When the diagram entry has been performed and checked on the Cadence CAD workstation, the Cadence file **.FAB** 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.

Due to the fact that the Cadence workstation typically uses the Unix operating system, the output ASCII text file has to be converted from Unix to MS-DOS format.

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

3. Cadence file format

This is a partial extract of an example of a Cadence output ASCII text file:

```
A!REFDES!COMP_CLASS!COMP_PART_NUMBER!COMP_HEIGHT!COMP_DEVICE_LABEL!COMP_INSERTION_CODE!SYM_TYPE!SYM_NAME!SYM_
MIRROR!SYM_ROTATE!SYM_X!SYM_Y!COMP_VALUE!COMP_TOL!COMP_VOLTAGE!COMP_RATED_CURRENT!COMP_RATED_POWER!COMP_RATED_
VOLTAGE!
J!/usr/local_users/spea.brd!Thu MM DD hh:mm:ss yyyy!-100.000!-
121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!U501!IC!520366351226!!U_XB_CUS_....MAR9125DIETR!!PACKAGE!USIGMA_AG!NO!0.000!69.100!9.300!!!!!!14!
S!U704!IC!520366300686!!U_XB_INT_.TJA1054U_N1,027!!PACKAGE!UTJA1054UB_AG!NO!90.000!39.700!4.950!!!!!!5.25!
S!Q1001!DISCRETE!520363550546!!Q_XB_..NM_..68W_.VND7NV04D!!PACKAGE!UVN7_AG!NO!0.000!40.550!27.550!!!!!68W!!
S!Q1002!DISCRETE!520363550546!!Q_XB_..NM_..68W_.VND7NV04D!!PACKAGE!UVN7_AG!NO!0.000!37.650!26.050!!!!!68W!!
S!Q1003!DISCRETE!520363550546!!Q_XB_..NM_..68W_.VND7NV04D!!PACKAGE!UVN7_AG!NO!270.000!46.600!28.000!!!!!68W!!
S!U701!IC!520366350918!!U_CB_CUS_.....MAR9113DIE1!!PACKAGE!UGIGA_AG!NO!0.000!9.850!19.850!!!!!!40!
S!C722!DISCRETE!520361413256!!C_CC1C_.100PF..+-
.5%_100V!!PACKAGE!C0805_AG!NO!180.000!35.700!3.850!100PF!5%!!!!100V!
……
A!NET_NAME!REFDES!PIN_NUMBER!PIN_NAME!PIN_GROUND!PIN_POWER!
J!/usr/local_users/spea.brd!Thu Feb 24 17:31:48 2000!-
100.000!121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!GNDMA1!U501!21!BACK!!!
S!CK_KNOCK!U501!11!CK!!!
S!UN1INDETON79PCS_KNOCK0!U501!7!CS!!!
S!UN1INDETON79PDIA_KNOCK_UP0!U501!5!DIA!!!
S!UN1INDETON79PGATE_KNOCK0!U501!14!GATE!!!
S!GNDMA1!U501!15!GND!!!
S!IN+_KNOCK!U501!6!IN1+!!!
S!IN-_KNOCK!U501!16!IN1-!!!
……
A!SYM_NAME!PIN_NAME!PIN_NUMBER!PIN_X!PIN_Y!PAD_STACK_NAME!REFDES!TEST_POINT!
J!/usr/local_users/spea.brd!Thu Feb 24 17:32:03 2000!-100.000!-
121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!USIGMA_AG!VCC!3!71.925!7.500!AU_300_700!U501!!
S!USIGMA_AG!SCK!9!70.000!12.625!AU_300_700!U501!!
S!USIGMA_AG!RDIA!4!71.700!8.100!AU_300_700!U501!!
S!USIGMA_AG!OV1!13!65.950!11.550!AU_300_900!U501!!
S!USIGMA_AG!OV0!12!67.500!12.500!AU_300_900!U501!!
S!USIGMA_AG!OUT!17!65.950!8.550!AU_300_900!U501!!
S!USIGMA_AG!MOSI!8!70.650!12.625!AU_300_700!U501!!
S!USIGMA_AG!MISO!10!69.400!12.625!AU_300_700!U501!!
……
A!VIA_X!VIA_Y!PAD_STACK_NAME!NET_NAME!TEST_POINT!
J!/usr/local_users/spea.brd!Thu Feb 24 17:32:06 2000!-100.000!-
121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!80.250!24.850!T1!GNDMT1!!
S!67.000!31.350!T1!GNDMT1!!
S!66.400!31.350!T1!GNDMT1!!
S!98.400!49.900!T2!!!
S!98.400!53.250!T3!!!
S!98.400!50.800!T3!!!
S!98.400!51.650!T6!!!
S!16.050!8.950!T5!UN1HYBRIDRES215PA0!!
……
A!CLASS!SUBCLASS!GRAPHIC_DATA_NAME!GRAPHIC_DATA_NUMBER!RECORD_TAG!GRAPHIC_DATA_1!GRAPHIC_DATA_2!GRAPHIC_DATA_3
!GRAPHIC_DATA_4!GRAPHIC_DATA_5!GRAPHIC_DATA_6!GRAPHIC_DATA_7!GRAPHIC_DATA_8!GRAPHIC_DATA_9!NET_NAME!
J!/usr/local_users/spea.brd!Thu Feb 24 17:32:08 2000!-100.000!-
121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!ETCH!AG3!LINE!257!1 1 0!96.250!38.650!96.250!45.600!0.000!!!!!!
S!ETCH!AG3!LINE!257!1 2 0!96.250!45.600!100.350!45.600!0.000!!!!!!
S!ETCH!AG3!LINE!257!1 3 0!100.350!45.600!100.350!38.650!0.000!!!!!!
S!ETCH!AG2!LINE!257!2 1 0!96.250!38.650!96.250!45.600!0.000!!!!!!
S!ETCH!AG2!LINE!257!2 2 0!96.250!45.600!100.350!45.600!0.000!!!!!!
S!ETCH!AG2!LINE!257!2 3 0!100.350!45.600!100.350!38.650!0.000!!!!!!
S!ETCH!AG2!LINE!257!2 4 0!100.350!38.650!96.250!38.650!0.000!!!!!!
……
```

The Import from Cadence CAD driver is able to correctly identify and use the following sections:

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

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

3.1 Part list

This section, basically, contains the part list and assembly data of each single device present in the Cadence CAD file; data are separated by "!".

Every single row of the Cadence file in this section, contains the following information:

1. Not used
2. **Drawing reference**
3. Not used
4. **Part number**
5. Not used
6. Not used
7. Not used
8. Not used
9. **Package name**
10. **Mounting side**
11. **Rotation**
12. **X-Coordinate**
13. **Y-Coordinate**
14. **Value/Device name**
15. **Tolerance**
16. Not used
17. Not used
18. Not used
19. Not used
20. Not used

The following example shows the syntax used for the **Part list** identifier:

1	2	3	4	5-8	9	10	11	12	13	14	15	16-20
Not used	Drawing ref.	Not used	Part Number	Not used	Package name	Mount. side	Rotation	X Coord	Y Coord	Value/ Device	Tol	Not used
S	U701	IC	5203635…		UGIGA_AG	NO	0	9.85	19.85			

Part list section is shown in the following example:

```
.....
A!REFDES!COMP_CLASS!COMP_PART_NUMBER!COMP_HEIGHT!COMP_DEVICE_LABEL!COMP_INSERTION_CODE!SYM_TYPE!SYM_NAME!SYM_MIRROR!S
YM_ROTATE!SYM_X!SYM_Y!COMP_VALUE!COMP_TOL!COMP_VOLTAGE!COMP_RATED_CURRENT!COMP_RATED_POWER!COMP_RATED_VOLTAGE!
J!/usr/local_users/spea.brd!Thu Feb 24 17:31:45 2000!-100.000!-
121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!Q1003!DISCRETE!520363550546!!Q_XB_..NM_..68W_.VND7NV04D!!PACKAGE!UVN7_AG!NO!270.000!46.600!28.000!!!!!68W!!
S!U701!IC!520366350918!!U_CB_CUS_.....MAR9113DIE1!!PACKAGE!UGIGA_AG!NO!0.000!9.850!19.850!!!!!40!
S!C722!DISCRETE!520361413256!!C_CC1C_.100PF..+-.5%_100V!!PACKAGE!C0805_AG!NO!180.000!35.700!3.850!100PF!5%!!!!100V!
S!C723!DISCRETE!520361413256!!C_CC1C_.100PF..+-.5%_100V!!PACKAGE!C0805_AG!NO!180.000!35.700!1.950!100PF!5%!!!!100V!
.....
```

3.2 Net list

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 Cadence file.

The “Import from Cadence” import CAD driver manages the following data:

1. Not used
2. **Net name**
3. **Drawing reference**
4. **Pin name**
5. Not used
6. Not used
7. Not used

The following example shows the syntax used for the **Net list** identifier:

1	2	3	4	5	6	7
Not used	Net name	Drawing ref.	Pin name	Not used	Not used	Not used
S	GNDMA1	U501	21	BACK		

Net list section is shown in the following example:

```
.....
A!NET_NAME!REFDES!PIN_NUMBER!PIN_NAME!PIN_GROUND!PIN_POWER!
J!/usr/local_users/spea.brd!Thu Feb 24 17:31:48 2000!-
100.000!121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!GNDMA1!U501!21!BACK!!!
S!UN1INDETON79PCS_KNOCK0!U501!7!CS!!!
S!IN+_KNOCK!U501!6!IN1+!!!
S!IN-_KNOCK!U501!16!IN1-!!!
.....
```

3.3 Pins Coordinates

This section is used to describe the device pin properties (package name, pin name and coordinates,…); data are separated by "!" in a row of the Cadence file.

The “Import from Cadence” import CAD driver manages the following data (without Mirror field):

Without Mirror field	Without Mirror field
1. Not used 2. **Package name** 3. Not used 4. **Pin name** 5. **X-Coordinate** 6. **Y-Coordinate** 7. Not used 8. **Drawing reference** 9. Not used	1. Not used 2. **Package name** 3. Not used 4. Not used 5. **Pin name** 6. **X-Coordinate** 7. **Y-Coordinate** 8. Not used 9. **Drawing reference** 10. Not used

The following example shows the syntax used for the **Pins coordinate** section:

Syntax 1 (without Mirror field)

1	2	3	4	5	6	7	8	9
Not used	Package name	Not used	Pin name	X-Coord.	Y-Coord.	Not used	Drawing ref.	Not used
S	USIGMA_AG	RDIA	4	71.700	8.100	AU_300_700	U501	

Syntax 2 (with Mirror field)

1	2	3-4	5	6	7	8	9	10
Not used	Package name	Not used	Pin name	X-Coord.	Y-Coord.	Not used	Drawing ref.	Not used
S	USIGMA_AG	RDIA	4	71.700	8.100	AU_300_700	U501	

The **Pins coordinate** section is shown in the following example:

```
.....
A!SYM_NAME!PIN_NAME!PIN_NUMBER!PIN_X!PIN_Y!PAD_STACK_NAME!REFDES!TEST_POINT!
J!/usr/local_users/spea.brd!Thu Feb 24 17:32:03 2000!-100.000!-
121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!USIGMA_AG!RDIA!4!71.700!8.100!AU_300_700!U501!!
S!USIGMA_AG!OV1!13!65.950!11.550!AU_300_900!U501!!
S!USIGMA_AG!OV0!12!67.500!12.500!AU_300_900!U501!!
S!USIGMA_AG!OUT!17!65.950!8.550!AU_300_900!U501!!
.....
```

3.4 Vias

This section is used to specify the properties for the via holes that can be used as test points; it can be decided to use a via hole as test point during the PCB development in Cadence.

Data are separated by "!" in a row of the CAD file and the “Import from Cadence” import CAD driver manages the following labels:

1. Not used
2. **X-Coordinate**
3. **Y-Coordinate**
4. Not used
5. **Net name**
6. **Access side/Mount side**

The following example shows the syntax used for the **Vias** section:

1	2	3	4	5	6
Not used	X-Coord.	Y-Coord.	Not used	Net name	Access side/Mount side
S	16.050	8.950	T5	UN1HYBRIDRES215PA0	

The **Vias** section is shown in the following example:

```
……
A!VIA_X!VIA_Y!PAD_STACK_NAME!NET_NAME!TEST_POINT!
J!/usr/local_users/spea.brd!Thu Feb 24 17:32:06 2000!-100.000!-
121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!66.400!31.350!T1!GNDMT1!!
S!98.400!49.900!T2!!!
S!98.400!53.250!T3!!!
S!16.050!8.950!T5!UN1HYBRIDRES215PA0!!
……
```

3.5 Tracks Coordinates

This section is used to specify the properties for the tracks data (layer name, net coordinates, net width, net name).

Data are separated by blanks in a row of the CAD file and the “Import from Cadence” import CAD driver manages the following labels:

1. Not used
2. Not used
3. **Layer**
4. **Line Type**
5. Not used
6. Not used
7. **X Start Coordinate**
8. **Y Start Coordinate**
9. **X End Coordinate**
10. **Y End Coordinate**
11. **Net width**
12. Not used
13. Not used
14. Not used
15. Not used
16. **Net name**

The following example shows the syntax used for the **Track coordinate** section:

1	2	3	4	5	6	7	8	9	10	11	12-15	16
Not used	Not used	Layer	Line type	Not used	Not used	X start coord.	Y start coord.	X end coord.	Y end coord.	Net width	Not used	Net name
S	ETCH	AG2	LINE	257	210	96.25	38.65	96.25	45.6	0		

The **Track coordinate** section is shown in the following example:

```
……
A!CLASS!SUBCLASS!GRAPHIC_DATA_NAME!GRAPHIC_DATA_NUMBER!RECORD_TAG!GRAPHIC_DATA_1!GRAPHIC_DATA_2!GRAPHIC_DATA_3
!GRAPHIC_DATA_4!GRAPHIC_DATA_5!GRAPHIC_DATA_6!GRAPHIC_DATA_7!GRAPHIC_DATA_8!GRAPHIC_DATA_9!NET_NAME!
J!/usr/local_users/spea.brd!Thu Feb 24 17:32:08 2000!-100.000!-
121.600!250.000!178.400!0.001!millimeters!PINOUT!21.4667 mil!21!OUT OF DATE!
S!ETCH!AG3!LINE!257!1 2 0!96.250!45.600!100.350!45.600!0.000!!!!!!
S!ETCH!AG3!LINE!257!1 3 0!100.350!45.600!100.350!38.650!0.000!!!!!!
S!ETCH!AG2!LINE!257!2 1 0!96.250!38.650!96.250!45.600!0.000!!!!!!
S!ETCH!AG2!LINE!257!2 4 0!100.350!38.650!96.250!38.650!0.000!!!!!!
……
```

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 test correctly some polarized devices such as diodes, bipolar transistors, etc., it is basic to correctly identify 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 Cadence file typically contains all information about the devices, such as tolerance value 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).

It 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 Cadence ASCII text file format

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

The Unix ASCII text files use the "$0a_{hex}$" ASCII character as end of line identifier.
The Windows® (MS-DOS) operating system uses the ASCII "$0d_{hex}$" and "$0a_{hex}$" characters as end of line identifier 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 Cadence ASCII file with this editor and save it, this operation will automatically perform the conversion from ASCII Unix to ASCII Windows® format.