

# **Productivity Toolbox User Guide**

## **Variant BOM**

**February 2017**

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# 1 Variant BOM – Overview

Both schematic tools – *Design Entry CIS* and *Design Entry HDL* – offer the ability to create variants. On the layout side the variant information can be taken to create variant specific assembly drawings. Variant Reports (BOM) can be generated from Schematic and from Layout, but until now it's not possible to include variant information into Pick&Place reports. This leads to a lack of flexibility, when variant Pick&Place data need to be generated.

**Variant BOM** is an application which allows the user to create various Pick&Place reports with the ability to take variant information into account.

This document describes the features and use model of this toolkit.

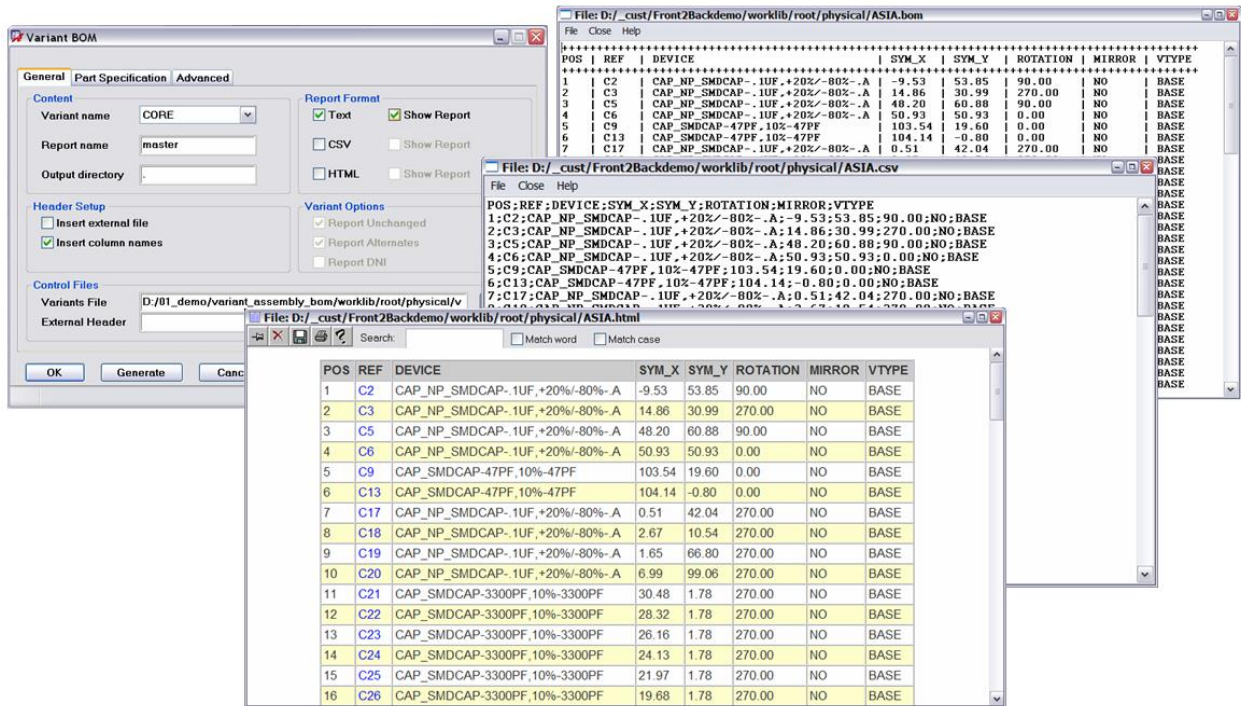


Figure 1: Variant BOM at a glance

The **Variant BOM** module covers the following aspects

- **Customizable content**  
The content of the report can be customized. Component attributes and layout relevant information like placement coordinates, rotation, mirror status etc. can be integrated into the report. In addition the report generator lets you specify the order in which the attributes are displayed.
- **Report types**  
**Variant BOM** offers the ability to create reports for the core design (not affected by any variant), a report for common parts (components which are common to all variants) and reports which are specific to a certain variant. For a common parts report and a variant report the information from the `variants.lst` file will be read and integrated into the report. In the report components are tagged, so that it's easy track which components are unaffected at all (*BASE*), components which have another value (*CHANGE*) or components which are not assembled at all (*DN*).
- **Report format**  
Three formats are available: A formatted text file, a csv file and html. The user can choose the appropriate format to be generated.
- **Format options**  
Various format options are available. For example the units and the number of decimal places for coordinates and rotation can be specified independently from the database units. You can also specify a default values for attributes which cannot be extracted (e.g. *NA*).

**Variant BOM** increases productivity and will help the customer to finish manufacturing data in a very short time.

## 2 Use model

### 2.1 Launching the utility

**Variant BOM** can be started from Pulldown menu or by entering the command `tbx varibom` in the console window.

Once the command has been launched a form will appear. It contains three tabs:

- *General*
- *Part Specification*
- *Setup*

The screenshot shows the 'Variant BOM' application window with the 'General' tab selected. The window has three tabs: 'General', 'Part Specification', and 'Advanced'. The 'General' tab contains several sections:

- Content:** A dropdown menu for 'Variant name' is open, showing options: ALL, CORE, COMMON, ALL, ASIA, EUROPE, USA. The 'Report name' field is set to 'COMMON'. The 'Output directory' field is empty.
- Report Format:** Three options are checked: 'Text', 'CSV', and 'HTML'. Each has a corresponding 'Show Report' checkbox, all of which are checked.
- Header Setup:** The 'Insert external file' checkbox is unchecked, and the 'Insert column names' checkbox is checked.
- Variant Options:** 'Report Unchanged' and 'Report Alternates' are checked, while 'Report DNI' is unchecked.
- Control Files:** The 'Variants File' field contains the path 'D:/01\_demo/variant\_assembly\_bom/worklib/root/physical/v' and has a browse button. The 'External Header' field is empty and has a browse button.

At the bottom of the window, there are six buttons: 'OK', 'Generate', 'Cancel', 'Save to', 'Load from', and 'Help'.

Figure 2: Variant BOM main form

## 2.2 Basic Use Model

The basic use model looks like this:

- Choose the type of report you want to generate in the *General* tab. When a `variants.lst` file is present in the current working directory of the board, the choices are
  - *CORE*
  - *COMMON*
  - *ALL*
  - *<Variant Name>*
- Specify the component attributes you want to extract in the *Part Specification* tab.
- Choose an appropriate report format – `text`, `csv` or `html`.
- Click *Generate*, a report will be generated
- Using *Save to* and *Load from* configurations can export and imported from and to other designs

## 2.3 Basic Concept

**Variant BOM** is a general purpose report generator. Thus it can be used to generate reports also on designs where no variants were specified. **Variant BOM** distinguishes between three types of reports.

- *CORE*  
When *CORE* is selected, the report will be generated without any variant information. **Variant BOM** extracts the attributes only from the PCB Editor database and ignores any `variants.lst` file.
- *COMMON*  
When this option is checked, a report will be generated that contains only parts which are common to all variants and the core design. Refer to the following simple example. A design contains three components, R1, C1 and L1. Three variants are defined: V1, V2 and V3. Component R1 is not changed at all, component C1 has a different value for each variant. Component L1 has also a different value compared to the core design, but the value is the same for all three variants. In this case a *COMMON* report would only list component R1, even though L1 is equal for variants V1, V2 and V3.

Component	Core	V1	V2	V3
R1	10k	10k	10k	10k
C1	33pF	56pf	68pf	22pf
L1	2.2nH	3.3nH	3.3nH	3.3nH



- *<Variant Name>*  
 Using this option a report for a particular variant will be generated. In a first step attributes from the core design will be read. In a second step the contents of the `variants.lst` file will be taken to build on overlay that is it will update all attributes from the core design component with the information from the `variants.lst` file. In addition the status for each component will be set to *BASE*, *CHANGE* or *DNI*. This status flag can be used to include or exclude components from the final variant report by enabling or disabling the following options
  - *Report Unchanged Parts*  
 When checked, all unchanged components (status *BASE*) will be reported. The default is on.
  - *Report Alternate Parts*  
 When checked, all alternate components (status *CHANGE*) will be reported. The default is on.
  - *Report DNI Parts*  
 When checked, all “Do Not Install” components (status *DNI*) will be reported. The default is off.

POS	REFDES	DEVICE	UTYPE	MIRROR	X	Y	ROT
1	C1	CAPACITOR_EL-10UF, 20%, 16, 4MM	BASE	NO	-127.000	317.500	0.000
2	C2	CAPACITOR_EL-10UF, 20%, 16, 4MM	BASE	NO	-119.380	317.500	0.000
3	C3	CAPACITOR_EL-10UF, 20%, 16, 4MM	BASE	NO	-111.760	317.500	0.000
4	UR3	MBZ5232B_SOT23-BASE	BASE	NO	-101.600	317.500	0.000
5	UR1	MBZ5232B_SOT23-BASE	BASE	YES	-101.600	325.120	0.000
6	UR2	MBZ5232B_SOT23-BASE	BASE	YES	-101.600	309.880	0.000
7	UR4	MBZ5232B_SOT23-BASE	BASE	YES	-101.600	335.280	0.000
8	R1	RESISTOR-22, 1/2W, 5%	CHANGE	NO	-109.220	307.340	0.000
9	R4	RESISTOR-56, 1/2W, 5%	CHANGE	NO	-109.220	299.720	0.000
10	R6	RESISTOR-110, 1/2W, 5%	CHANGE	NO	-101.600	302.260	0.000
11	R2	RESISTOR-33, 1/2W, 5%	CHANGE	YES	-109.220	335.280	0.000
12	R3	RESISTOR-47, 1/2W, 5%	CHANGE	YES	-109.220	325.120	0.000
13	R5	RESISTOR-68, 1/2W, 5%	CHANGE	YES	-111.760	330.200	0.000
14	Q1	MBT2222A_SOT223H-BASE	DNI	NO	-121.920	302.260	0.000
15	J1	JACK_4_TYPE1-4PIN	DNI	YES	-124.460	330.200	0.000

Figure 3: Variant report example

- *ALL*  
 This option is similar *<Variant name>* except that the reports will be generated for any variant found in the `variants.lst` file.

## 3 Detailed Description

### 3.1 General Tab

#### 3.1.1 Content and Variant Options

Figure 4: Content

As described in section 2.3, reports can be generated for

- *CORE*                      Core design
- *COMMON*                *Common parts*
- *ALL*                        All variants from `variants.lst` file
- *<Variant Name>*        Particular variant report

Depending on the selected item, section *Variant Options* is active or inactive.

Figure 5: Variant options

When *CORE* is chosen, variant options are grayed out. The default name of the report file is `master`. Enter another name in the *Report Name* field without an extension.

When *COMMON* is chosen, variant options are grayed out also. The default name of the report file is `common`. Enter another name in the *Name* field without an extension.

When *ALL* is chosen or a particular variant has been selected, variant options are available. When a particular variant such as `VARI_1` is selected the default name for the report is the variant name. The name can be still changed. When *ALL* is selected, a report for each variant will be created automatically. In this case the name of the report cannot be edited, and will be derived always from the variant name. In *Variant Options* it's possible to include or exclude components from the report, as described above. The default is to include unchanged and alternate components and to exclude *DNI* components.



Note: When a `variants.lst` file was not found in the current working directory reports can be created for the core design only.

Furthermore the output directory can be specified by entering a value in field *Output directory*. Relative paths are recommended.

### 3.1.2 Report Format

Three different file formats can be specified.

- *Text*  
A formatted text file will be generated.
- *CSV*  
A comma separated file will be generated. The default delimiter being used is “;”.
- *HTML*  
An HTML file will be generated. It can be opened with any web browser.

Each option offers a *Show Report* checkbox, which – when checked – automatically opens the corresponding report in a viewer.

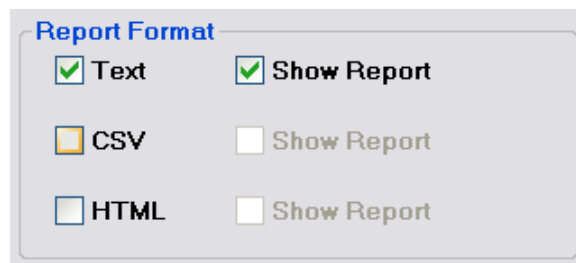


Figure 6: Report Format options

### 3.1.3 Header Setup

In this section the header of the report can be specified

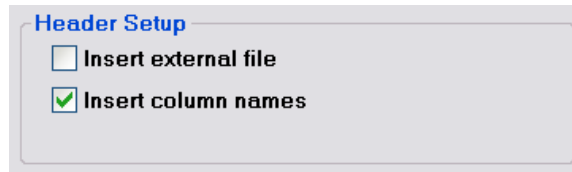


Figure 7: Header Setup

- Insert external file*  
 An external file can be included into the report. It will be printed always to the beginning of the report. The external header file can be specified in section *Control Files*. The default value is off.

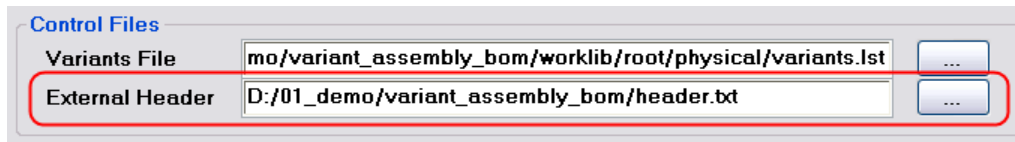


Figure 8: External header file location

- Insert columns names*  
 If checked, the column names from the *Part Specification* Tab will be included into the report. The default value is on.

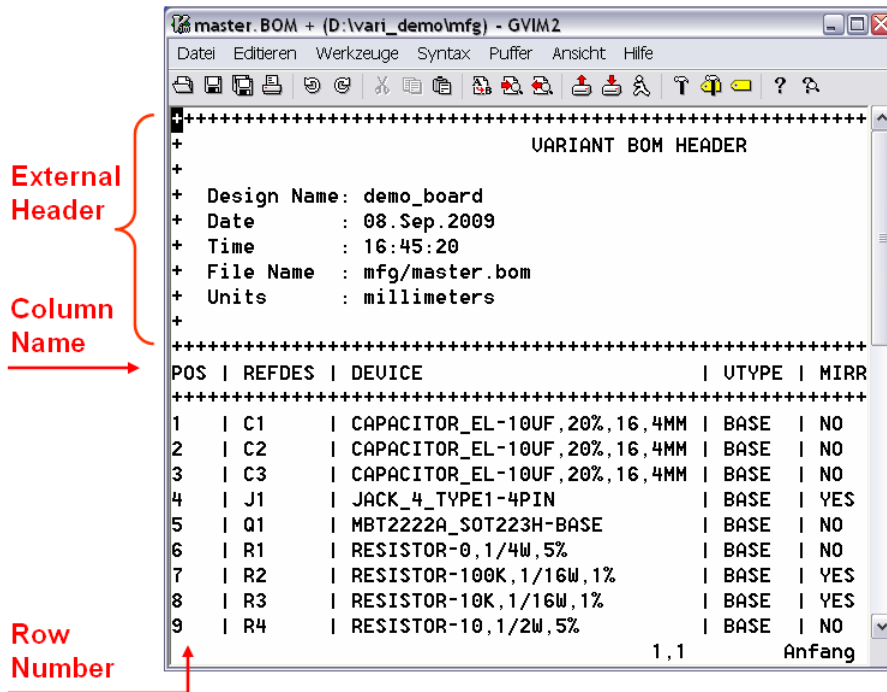



Figure 9: Example report with header information



When using an external header file field functions for DESIGN, DATE, TIME, FILE, UNITS can be used. The values will be populated automatically when the report is being generated. The variables have to be enclosed by "\$".

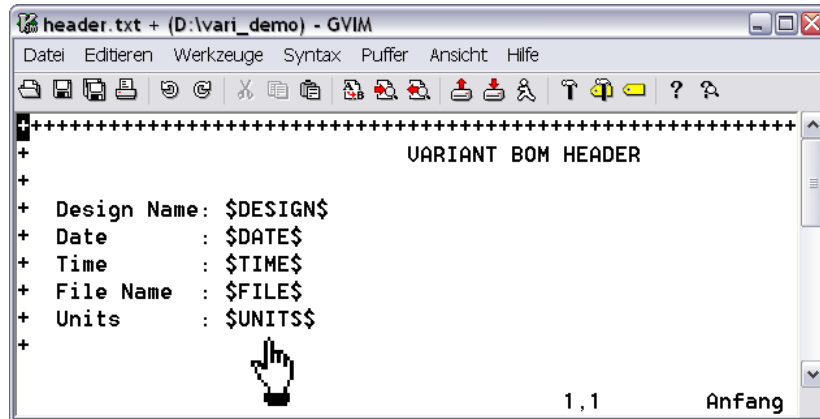


Figure 10: External header file with field functions

### 3.1.4 Control files

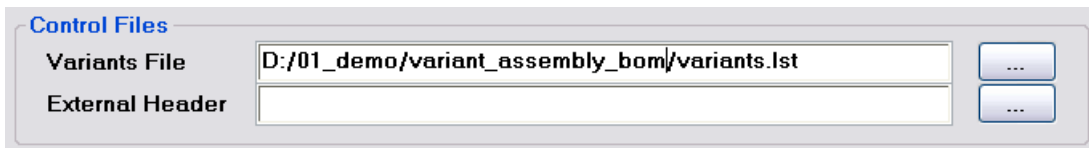


Figure 11: Control file locations

When **Variant BOM** is launched it searches the current working directory for a file called `variants.lst`. If found the contents will be loaded and the field *Variant File* will be populated. Using the *Load* button it's possible to load a variant file from another location.

In the field *External Header* the location of an external header file can be specified. The contents will be put into the report only, when the option *Insert external file* is checked (refer to section *Header Setup*).

## 3.2 Part Specification Tab

### 3.2.1 Component attributes

In this tab the component attributes to be extracted can be defined.

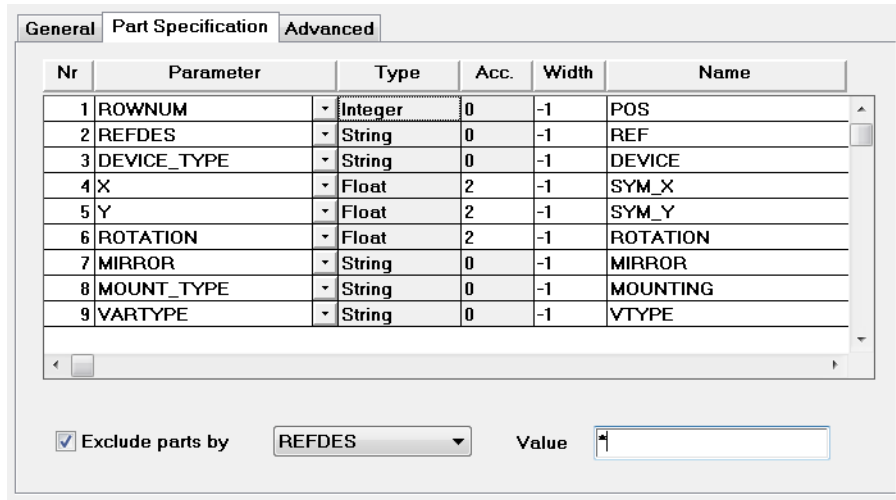


Figure 12: Part Specification grid

Each row defines one parameter.

- The first column *Nr* specifies the order the parameters appear in the final report. The values can be changed manually. However the grid will be sorted always. Entering a number will therefore automatically exchange the corresponding rows.
- The second column *Parameter* defines the parameter name to be extracted. Pre-Defined and User-Defined parameters are supported. Refer to 6 (**Appendix B**) for a description of Pre-Defined parameters. A User-Defined parameter can be any property which is attached to a component (definition or instance) in the PCB Editor database. You can select the select Pre-Defined parameters from the Drop-Down list or enter your own parameter manually.

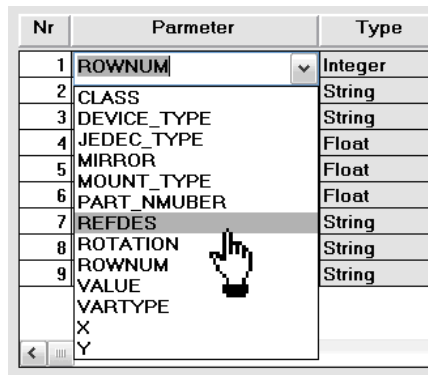




Figure 13: Pre-Defined parameter Drop-Down

- The third column *Type* defines the type of the parameter. Three values are possible: String, Float and Integer.

- The fourth column *Acc.* defines the accuracy (number of decimal places). The value can be edited only when parameter type is `Float`.
- The fifth column specifies the width of the column. It applies to text reports only and specifies the number of characters to use. Use a value of -1 in order to disable fixed widths.

 Please note: If values equal or greater than 1 have been specified **Variant BOM** always truncates parameter values to the specified width.


- The last column *Name* defines the display name in the report. So it's possible to specify an alternate leaving the extraction parameter unchanged.

 In case of predefined parameters (refer To **Appendix B** for a complete list) the *Type* field is always read only. The *Type* field can be changed for custom attributes only. In addition *Accuracy* can be edited only, when *Type* is equal "Float"

Using the context menu it's possible to insert, delete, move up or move down one row.

Nr	Parameter	Type	Acc.	Width	Name
1	ROWNUM	Integer	0	-1	POS
2	REFDES	String	0	-1	REF
3	DEVICE_TYPE	String	0	-1	DEVICE
4	X	Float	2	-1	SYM_X
5	Y	Float	2	-1	SYM_Y
6	ROTATION		2	-1	ROTATION
7	MIRROR		0	-1	MIRROR
8	MOUNT_TYPE		0	-1	MOUNTING
9	VARTYPE		0	-1	VTYPE

Figure 14: Context menu for grid operations


 Note: When you try to delete the row specifying `REFDES` or `VARTYPE` a popup confirmer appears and informs that these parameters cannot be deleted.

Furthermore parts that should not appear in the BOM at all can be excluded using checkbox *Exclude parts by*. You can choose from *Refdes*, *DeviceType* and *BOM\_IGNORE*. Wildcards are supported when you specify the match pattern for the value.



The screenshot shows a user interface for excluding parts from a BOM. A checkbox labeled "Exclude parts by" is checked. To its right is a dropdown menu with four options: "BOM\_IGNORE", "REFDES", "DEVICE\_TYPE", and "BOM\_IGNORE". The first "BOM\_IGNORE" option is selected. To the right of the dropdown is a text input field labeled "Value" containing the text "TP\*".

Figure 15: Excluding parts from BOM



You can use the “|” character when you need to specify multiple match pattern. The following example excludes all parts where the reference designator starts either with “TP\*” or “XT\*”



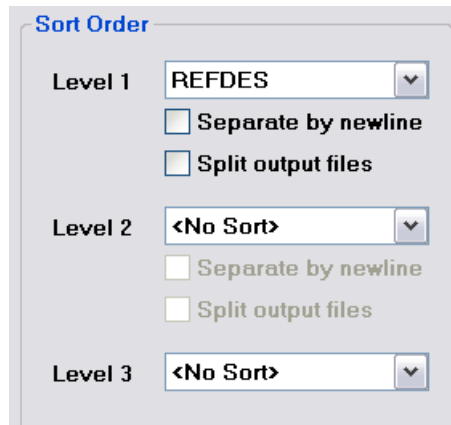
The screenshot shows the same user interface as Figure 15, but with the dropdown menu set to "REFDES" and the "Value" field containing the wildcard pattern "TP\*|XT\*".

Figure 16: Excluding parts using wildcard pattern

## 4 Advanced Tab

### 4.1.1 Sort Order

Variant BOM supports a hierarchical sorting up to three sorting levels.



The screenshot shows a dialog box titled "Sort Order". It has three sections, one for each sorting level. Level 1 has a dropdown menu set to "REFDES", a checkbox for "Separate by newline" which is unchecked, and a checkbox for "Split output files" which is unchecked. Level 2 has a dropdown menu set to "<No Sort>", a checkbox for "Separate by newline" which is unchecked, and a checkbox for "Split output files" which is unchecked. Level 3 has a dropdown menu set to "<No Sort>".

Figure 17: Sort Order

Three parameters can be specified. The default value for *Level 1* is REFDES, *Level 2* and *Level 3* are unspecified. The following examples illustrate the sort settings in some more detail.



Example 1:

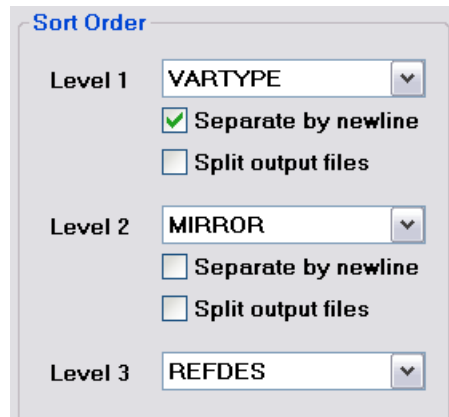


Figure 18: Sort Order example

In this example *Level 1* is set to VARTYPE, *Level 2* to MIRROR and *Level 3* to REFDES. The components are sorted first with respect to variant type BASE, CHANGE and DNI. For each variant type components are then sorted with respect to mirror status NO and YES. For each mirror status components are then sorted with respect to reference designator.

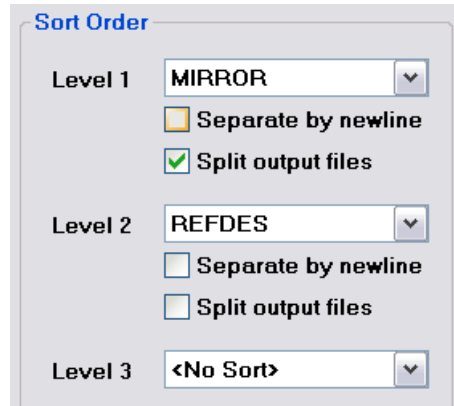
POS	REFDES	DEVICE	UTYPE	MIRROR	X	Y	ROT
1	C1	CAPACITOR_EL-10UF,20%,16,4MM	BASE	NO	-127.000	317.500	0.000
2	C2	CAPACITOR_EL-10UF,20%,16,4MM	BASE	NO	-119.380	317.500	0.000
3	C3	CAPACITOR_EL-10UF,20%,16,4MM	BASE	NO	-111.760	317.500	0.000
4	UR3	MBZ5232B_SOT23-BASE	BASE	NO	-101.600	317.500	0.000
5	UR1	MBZ5232B_SOT23-BASE	BASE	YES	-101.600	325.120	0.000
6	UR2	MBZ5232B_SOT23-BASE	BASE	YES	-101.600	309.880	0.000
7	UR4	MBZ5232B_SOT23-BASE	BASE	YES	-101.600	335.280	0.000
8	R1	RESISTOR-22,1/2W,5%	CHANGE	NO	-109.220	307.340	0.000
9	R4	RESISTOR-56,1/2W,5%	CHANGE	NO	-109.220	299.720	0.000
10	R6	RESISTOR-110,1/2W,5%	CHANGE	NO	-101.600	302.260	0.000
11	R2	RESISTOR-33,1/2W,5%	CHANGE	YES	-109.220	335.280	0.000
12	R3	RESISTOR-47,1/2W,5%	CHANGE	YES	-109.220	325.120	0.000
13	R5	RESISTOR-68,1/2W,5%	CHANGE	YES	-111.760	330.200	0.000
14	Q1	MBT2222A_SOT223H-BASE	DNI	NO	-121.920	302.895	0.000
15	J1	JACK_4_TYPE1-4PIN	DNI	YES	-122.492	336.804	0.000

Figure 19: Example report for hierarchical sorting

Since option *Separate by newline* was checked for *Level 1* an empty line will be added once the value of the *Level 1* parameter changes. In the example above this is the change BASE → CHANGE and CHANGE → DNI.

By checking *Separate by newline* for *Level 2* an empty line would be added also between lines, where the mirror values change from NO to YES

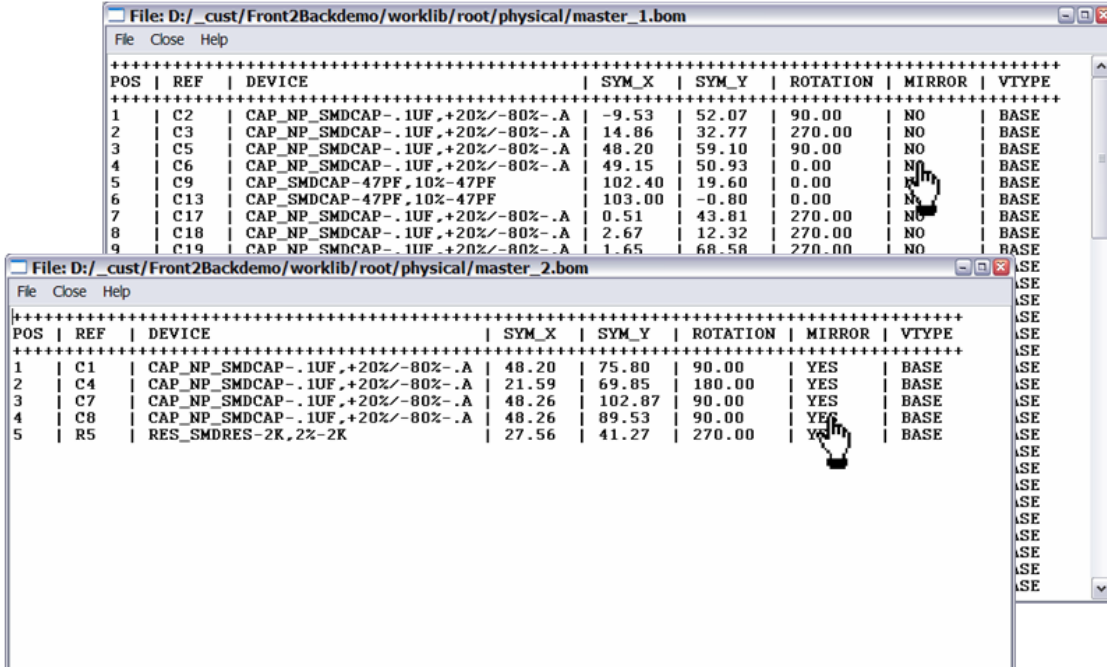
**Example 2:**



**Figure 20: Split output files option**

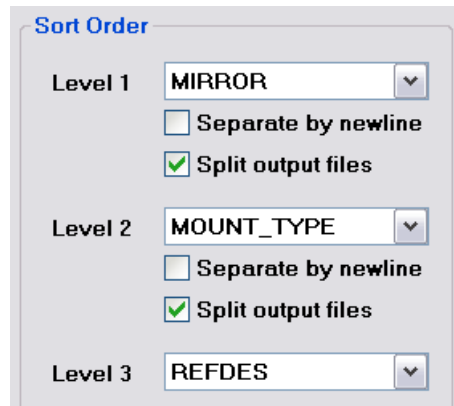
In this example *Level 1* is set to MIRROR and *Level 2* to REFDES. *Level 3* is unspecified. The components are sorted first with respect to mirror status NO or YES. For each mirror value components are then sorted with respect to reference designator.

Since option *Split output files* is checked the report is split into several files depending on the number of values of *Level 1* sort parameter, in this case 2 files. The generated files are numbered sequentially.



**Figure 21: Split output files Level 1**

**Example 3:**



In this example *Level 1* is set to MIRROR, *Level 2* to MOUNT\_TYPE and *Level 3* to REFDES. The components are sorted first with respect to mirror status YES/NO. For each mirror value components are then sorted with respect to MOUNT\_TYPE THT or SMT(See appendix 6 [Appendix B: List of Pre-Defined parameters](#) for a description of parameter MOUNT\_TYPE). For each MOUNT\_TYPE value components are sorted with respect to eference designator. Since *Split output files* has been selected for *Level 1* and *Level 2*, four report files will be generated. The generated files are numbered sequentially.

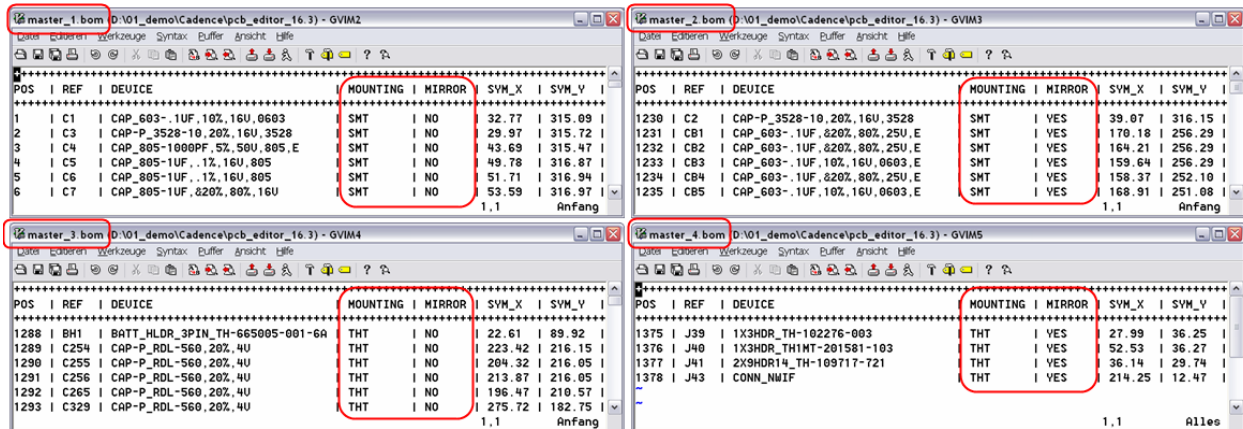


Figure 22: Split output files Level 1 and Level 2

### 4.1.2 Footprint location

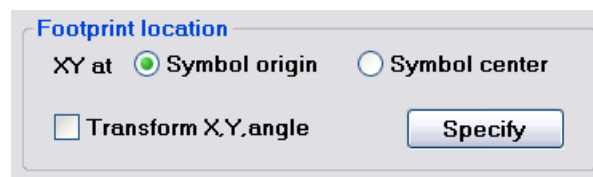
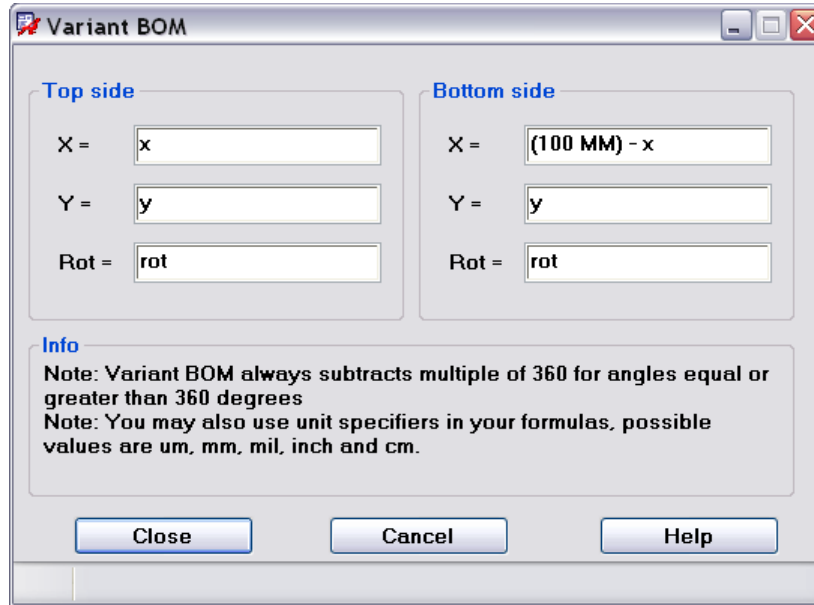


Figure 23: Reference point for footprint coordinates

When extracting placement coordinates the origin as defined by the footprint will be taken as reference point. In some cases users want to calculate the footprint center instead. When *Symbol center* is checked PCB Editor always extracts the center of the footprint. The default value is *Symbol origin*.

In addition it's possible to transform coordinates including rotation if necessary. For example users may want to reference the x coordinate for components on the bottom side to another location. First you need to specify the formulas by choosing *Specify*.



**Figure 24: Coordinate transformation**

The formulas for top and bottom can be specified separately. Enabling *Transform X,Y,angle* will then recalculate the corresponding values based on the specified formulas.



Note: It's possible to use unit specifiers such as `um`, `mm`, `mil`, `inch`, `cm` so that it does not affect the calculation when design units are changed. Do not use any other unit specifiers in your formula, as this will lead to errors.

### 4.1.3 Miscellaneous

Additional format options are available:

Figure 25: Miscellaneous options

- **Undefined Values**

If for some reason an attribute value cannot be extracted (e.g. unplaced components, where placement coordinates could not be extracted), the value that appears in the report can be specified in the field *Undef value*. The default is *NA*.

```

+++++
| X      | Y      | ROT
+++++
| -127.000 | 317.500 | 0.000
| -119.380 | 317.500 | 0.000
| -111.760 | 317.500 | 0.000
| -122.492 | 336.804 | 0.000
| -121.920 | 302.895 | 0.000
| -109.220 | 307.340 | 0.000
| NA      | NA      | NA
| NA      | NA      | NA
| -109.220 | 299.720 | 0.000
    
```

Figure 26: Defaults for undefined values

- **Report values for mirror**

Sometimes the mirror status for component needs to be extracted, whether it is placed on the top or the bottom side. The report values can be specified in the field *Mirror*. The options are:

- *Yes/No*
- *Top/Bot*
- *0/1*
- *A/B*

- **Decimal point**

The default decimal point for floating values used by **Variant BOM** is the dot character (“.”). If necessary the comma character (“,”) can be used instead.

- **Units**

If placement data need to be extracted (x,y, rotation), the output units can be specified. There is no need to change the database units.

- **Text report**

- **File extension**

The report file name extension can be specified. The default value is “bom”. That means that the full name for report is for example `master.bom`.

Note: The extension will be applied only to the formatted text file. The extensions for `csv` and `html` are not affected by this setting.

- **Column separator**

When this option is checked the individual columns of the text report will be separated by “ | ”.

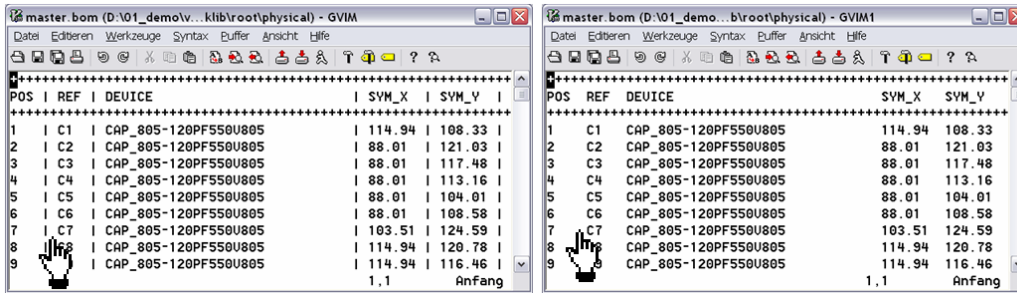


Figure 27: Column separator in text report



Note: When reports with fixed width columns need to be generated (for the purpose of additional post processing) users should disable this checkbox.

- **CSV report**

- **Separator**

The default CSV separation character used by **Variant BOM** is the “;” character. Another character can be specified here if necessary.

## 5 Appendix A: Additional Variables

This is an optional chapter and describes additional environment variables.

### 5.1 Variable `TBX_VARIBOM_MAX_OPEN_WINDOWS`

When choosing the *Show report* option (refer to section *Report Format*) the final report is shown in a separate window. If the form settings lead to more than one report to be generated it might happen that many report windows have to be opened. The default limit is not to open more than 5 files simultaneously. Using this variable a higher limit can be specified.

For example:

```
set TBX_VARIBOM_MAX_OPEN_WINDOWS = 10
```

### 5.2 Variable `TBX_VARIBOM_MAX_SPLIT_CNT`

When option *Split output files* is enabled (refer to section *Sort Order*) the final report is split into several files depending on the values of the *Level 1* sort parameter. If, for example, *Level 1* is set to `Refdes`, many files would be generated which is obviously not intended.

In such a case a popup confirmer appears and asks to continue or abort the process when more than 10 output files have been generated.

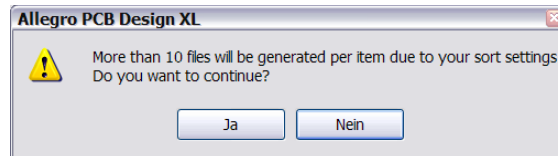


Figure 28: Warning message

Using this variable a higher limit can be specified.

```
set TBX_VARIBOM_MAX_SPLIT_CNT = 20
```

## 6 Appendix B: List of Pre-Defined parameters

Name	Description															
ROWNUM	Row number (pseudo parameter), if selected the row number will be written to the report.															
REFDES	Reference Designator															
CLASS	Component Class such as DISCRETE, IC or IO															
DEVICE_TYPE	Component DeviceType															
JEDEC_TYPE	Component footprint															
X	Placement coordinate X															
Y	Placement coordinate Y															
ROTATION	Component rotation in degrees															
MIRROR	Component mirror status. If true, the component is placed on the BOTTOM side. Otherwise it's placed on TOP.															
VARTYPE	Defines the variant status of a component. Values are BASE, CHANGE, or DNI															
MOUNT_TYPE	<p>Specifies the mounting type of the component for example SMT or THT. If the property is attached to the component definition (or instance) the value will be taken. In addition – when the property is not found on the component - <b>Variant BOM</b> automatically extracts the mounting type by analyzing the electrical pins of the footprints (not mechanical pins!!).</p> <table border="1" data-bbox="675 1184 1243 1423"> <thead> <tr> <th>SMD pads</th> <th>THT pads</th> <th>MOUNTING_TYPE</th> </tr> </thead> <tbody> <tr> <td>NO</td> <td>NO</td> <td>UNDEF</td> </tr> <tr> <td>NO</td> <td>YES</td> <td>THT</td> </tr> <tr> <td>YES</td> <td>NO</td> <td>SMT</td> </tr> <tr> <td>YES</td> <td>YES</td> <td>UNDEF</td> </tr> </tbody> </table>	SMD pads	THT pads	MOUNTING_TYPE	NO	NO	UNDEF	NO	YES	THT	YES	NO	SMT	YES	YES	UNDEF
SMD pads	THT pads	MOUNTING_TYPE														
NO	NO	UNDEF														
NO	YES	THT														
YES	NO	SMT														
YES	YES	UNDEF														