

# PowerEsim User Manual

A Switching Power Converter Design  
Platform on the Internet

**www.powerEsim.com**



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Apache Tomcat <http://jakarta.apache.org>  
MySQL <http://www.mysql.com>  
SUN JAVA <http://java.sun.com>

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## 1 Introduction

### 1.1 A New CAD tool on the Internet for Switching Power Supplies

PowerEsim is a CAD tool for switching power supplies on the Internet. This new concept eliminates complicated licensing and software installation process. Design service is readily available anytime, anywhere. It is so easy to use through a generic Web browser that you need no training.

Its huge component database contains thousands of items available in the market. Complete Bill of Materials is available at a click on the mouse. Reports are ready and no more effort to produce tedious documents.

### 1.2 Powerful Integrated features

### 1.3 A Tool for Engineers

Choose a circuit topology, put in your power supply specifications and click. A complete design is ready. Optimize the design automatically or manually to produce the best product performance.

### 1.4 A Tool for Managers

Fast response to RFQs, more control on product cost and better product quality. Surprise your customers by the speed and details of your proposals with the help of ready to use reports from PowerEsim.

### 1.5 A Tool for Component Vendors

Promote your components directly to product design engineers through PowerEsim. No more application notes needed. No more delay due to design mistakes.

### 1.6 A Tool for Trainees

Students and trainees learn quickly through PowerEsim. Simulated waveforms and analysis give real life demonstration.

### 1.7 Subscription

Please send your request to [sales@powerelab.com](mailto:sales@powerelab.com)







## 2 System Requirement

Flash Player 8, IE 6.0 on Windows XP OS, Safari on MAC OS


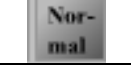























### 3 User Interface Practice

#### 3.1 Button Color and Practice

	Description	Function
	Button with arrow up/down	Sorting
	Blue button	Open New Module window
	Grey button	Open sub-page
	Green button	Apply changes

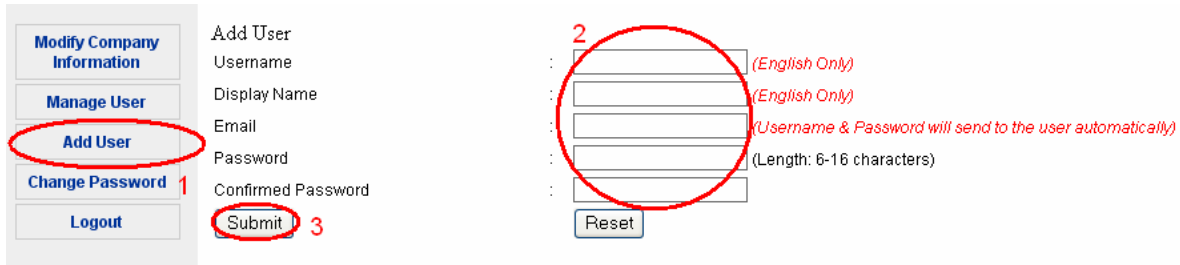
#### 3.2 Button in Thermal Analysis

	Attach 2 components together
	Change to Normal View
	Zoom in
	Zoom out
	Lock/Unlock the Component in Current Position
	Group the selected components
	Ungroup / Unattach the selected components
	View the temperature of component and the thermal effect on the PCB
	Don't show the temperature of component
	Top view
	Bottom side view of PCB
	Left side view
	Front side view
	Right side view

	Back side view
	3D view
	Rotate the component by clockwise 90°
	Rotate the component by anti-clockwise 90°
	Rotate the component by clockwise 90° in front
	Rotate the component by anti-clockwise 90° in front
	Put the component on Main PCB
	Print Preview
	This is the help function about the interface such as function keys

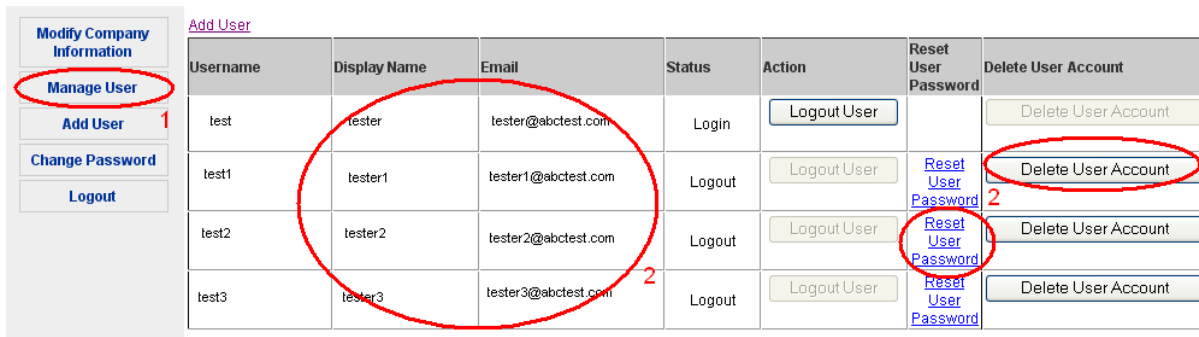
## 4 PowerEsim Account Management

### 4.1 Add user account (for Administrator only)



1. Click the link “Add User”
2. Fill in all information
3. Press “Submit” after confirmation

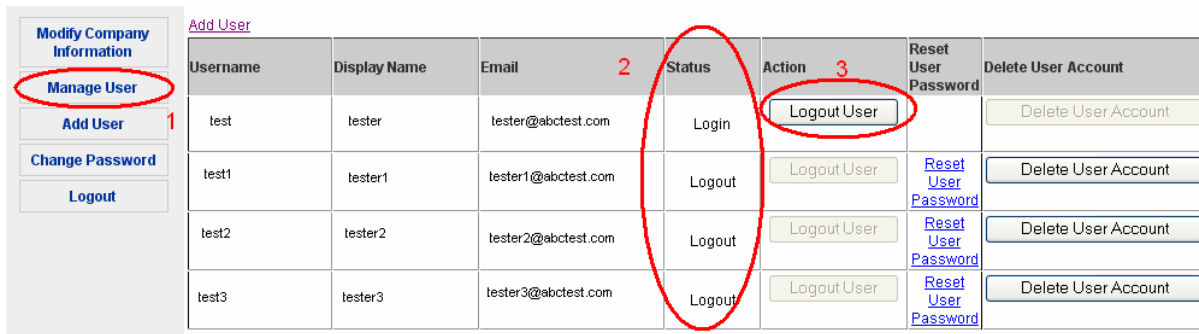
### 4.2 Manage user account (for Administrator only)



Username	Display Name	Email	Status	Action	Reset User Password	Delete User Account
test	tester	tester@abctest.com	Login	<a href="#">Logout User</a>		<a href="#">Delete User Account</a>
test1	tester1	tester1@abctest.com	Logout	<a href="#">Logout User</a>	<a href="#">Reset User Password</a>	<a href="#">Delete User Account</a>
test2	tester2	tester2@abctest.com	Logout	<a href="#">Logout User</a>	<a href="#">Reset User Password</a>	<a href="#">Delete User Account</a>
test3	tester3	tester3@abctest.com	Logout	<a href="#">Logout User</a>	<a href="#">Reset User Password</a>	<a href="#">Delete User Account</a>

1. Click the link “Manage User”
2. You can view user information, reset user password or delete the user account

### 4.3 Logout user(s) (for Administrator only)



Username	Display Name	Email	Status	Action	Reset User Password	Delete User Account
test	tester	tester@abctest.com	Login	<a href="#">Logout User</a>		<a href="#">Delete User Account</a>
test1	tester1	tester1@abctest.com	Logout	<a href="#">Logout User</a>	<a href="#">Reset User Password</a>	<a href="#">Delete User Account</a>
test2	tester2	tester2@abctest.com	Logout	<a href="#">Logout User</a>	<a href="#">Reset User Password</a>	<a href="#">Delete User Account</a>
test3	tester3	tester3@abctest.com	Logout	<a href="#">Logout User</a>	<a href="#">Reset User Password</a>	<a href="#">Delete User Account</a>

1. Click the link “Manager User”
2. View the user status (login/logout)
3. Logout the user who occupy the seat (login)

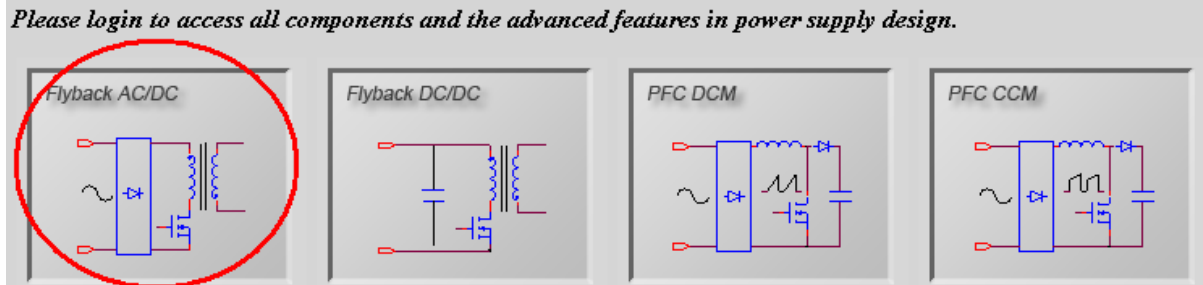
#### 4.4 Change password

The screenshot shows a user management interface. On the left is a sidebar menu with five options: 'Modify Company Information', 'Manage User', 'Add User', 'Change Password', and 'Logout'. The 'Change Password' option is circled in red and labeled with a red '1'. The main content area contains a form with the following fields: 'Username' with the value 'test', 'Old Password' (empty), and 'New Password' (empty) with a note '(Length: 6-16 characters)'. The 'Old Password' and 'New Password' input boxes are circled in red and labeled with a red '2'. A 'Submit' button is also circled in red and labeled with a red '3'.

1. Click the link “Change Password”
2. Input the old password and new password
3. Press “Submit” when done

## 5 Getting Start

### 5.1 Select topology at front page



Click on any topology window to select a topology

### 5.2 Select topology at other sub-page



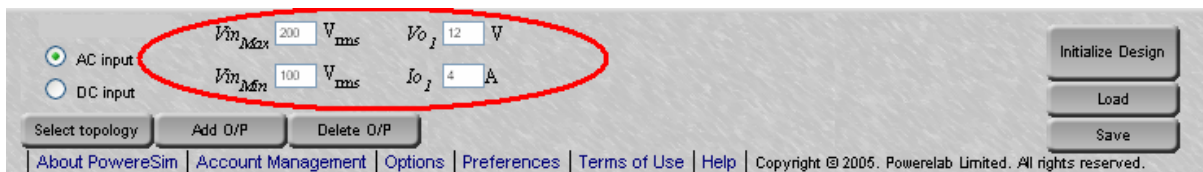
You can click “Select topology” to go back to front page to select another topology

### 5.3 Add more outputs



Click the link “Add O/P” to add more output.

### 5.4 Changing input voltage and current



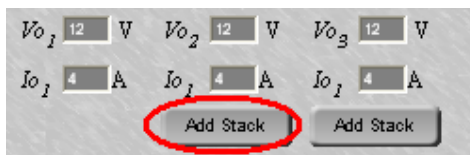
Enter the input voltage range  $V_{in_{Min}}$  -  $V_{in_{Max}}$ , output voltage  $V_o$  and rated current  $I_o$  at each output.

## 5.5 First thing to do - Initialize Design



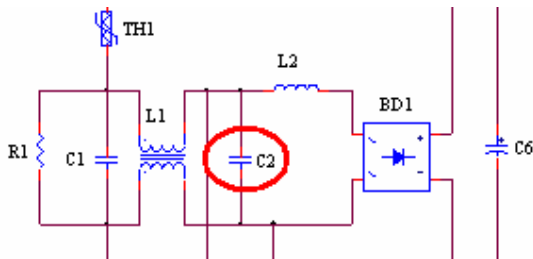
Once input and output are defined, press the button “Initialize Design.” A preliminary design will be recommended by PowerEsim.

## 5.6 Add Stack Winding



You can press “Add Stack” to add ac stack winding before and after the design initialized.

## 5.7 Select a part from schematic page



After design initialized, you can click on the component to go into the component selection user interface.

## 5.8 Component Selection User Interface – searched components box

The screenshot displays the component selection user interface. At the top, there are dropdown menus for 'in parallel' and 'in series', both set to '1'. A 'FrontView' window shows a capacitor component. The main search area includes a 'Load Capacitor from File' button and a search criteria box with the following values: 300 V, 165n F, and 660n F. A 'Search' button is located to the right of the search criteria. Below the search criteria is a list of searched components with columns for capacitance, voltage, temperature, dimensions, and manufacturer. The list includes components from ARCOTRONICS, WIMA, and PHE840E. The interface also features buttons for 'Select One', 'Select All', 'Delete One', and 'Delete All', along with a 'Component Analysis' button and a 'Component Characteristic' button. The bottom section shows a 'Replace selection by double-clicking the one selected in list' instruction and 'Done' and 'Cancel' buttons.

1. Fill in the range of the searching criteria, and press “Search,” all the component fulfill the criteria will be displayed at the searched components box and ready to be chosen.
2. “Total Losses” will be shown for the converter using the highlighted component.
3. “Highlighted Losses” will be shown for the highlighted component.



## 5.9 Change a component from database

The screenshot shows the PowerLab software interface. At the top, there is a 'PowerSIM' logo and a circuit diagram with a capacitor labeled 'C2'. Below this, there are dropdown menus for 'in parallel' and 'in series', both set to '1'. A 'FrontView' window shows a capacitor component with a '0.0050m' dimension. The main area contains a list of components, with the first one highlighted in blue and circled in red (labeled '1'). Below the list, there are buttons for 'Select One' (circled in red and labeled '2'), 'Select All', 'Delete One', and 'Delete All'. The 'Total Losses' and 'Highlighted Losses' are displayed. To the right, there are input fields for voltage (200 V), frequency (165n F), and capacitance (660n F), along with a 'Search' button. Below these are dropdown menus for 'Capacitor Type', 'Safety Type', 'Package Type', and 'Manufacturer'. At the bottom, there are checkboxes for 'Enable Optimization' and 'Alternative Component', and a 'Done' button (circled in red and labeled '3') next to a 'Cancel' button. A red text note at the bottom says 'Replace selection by double-clicking the one selected in list'.

1. Select any one component from the searched components box
2. Click “Select One”
3. “Total Losses” will be shown for the converter using the selected component.
4. “Selected Losses” will be shown for the selected component.
5. Press “Done” after selection



## 5.10 Preview Component shape

The screenshot shows the PowerLab software interface. At the top left, there is a logo for PowerLab SIM and a circuit symbol with 'C2' next to it. Below this, there are two dropdown menus for 'in parallel' and 'in series', both set to '1'. In the top right corner, there is a 'FrontView' window showing a component shape, which is circled in red and labeled '2'. Below this, there is a list of components. The first component in the list is highlighted in blue and circled in red, labeled '1'. The list contains various capacitor specifications. To the right of the list, there is a search bar and several dropdown menus for 'Capacitor Type', 'Safety Type', 'Package Type', and 'Manufacturer'. Below the list, there are buttons for 'Select One', 'Select All', 'Delete One', and 'Delete All'. At the bottom right, there are buttons for 'Done' and 'Cancel'. A red text note at the bottom left of the interface reads: 'Replace selection by double-clicking the one selected in list'.

1. Highlight any one component from the list
2. The component's shape is shown at upper right corner

## 5.11 Analysis Particular Component

The screenshot shows the PowerESim software interface. At the top, there is a 'Power SIM' logo and a circuit symbol with 'C2' and dropdown menus for '1 in parallel' and '1 in series'. A 'FrontView' window shows a capacitor component with a 0.0059m scale bar. The main area features a list of components, with the first one, '330n F 440 VAC 110°C 26.5x22x13 mm R.47 ARCOTRONICS 10%', highlighted in blue and circled in red. Below the list are buttons for 'Select One', 'Select All', 'Delete One', and 'Delete All'. To the right, there are input fields for voltage (200 V), capacitance (185n F), and search filters for Capacitor Type, Safety Type, Package Type, and Manufacturer. A 'Component Analysis' button is circled in red. At the bottom, there are 'Done' and 'Cancel' buttons and a red instruction: 'Replace selection by double-clicking the one selected in list'.

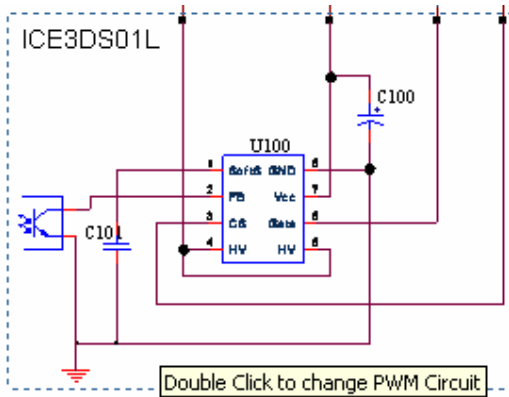
1. Highlight any one component from the list
2. Press “Component Analysis”
3. A component analysis page will be displayed.
4. If highlighted component is changed, press “Component Analysis” again to refresh.

## 5.12 View Component Characteristics

The screenshot shows the PowerESim software interface for selecting a component. A list of capacitor specifications is displayed, with the first entry highlighted. A red circle labeled '1' points to this entry. To the right, there are search filters for Voltage (200V), Frequency (165nF), and other parameters. Below the list, there are buttons for 'Select One', 'Select All', 'Delete One', and 'Delete All'. A 'Component Characteristic' button is highlighted with a red circle labeled '2'. At the bottom, there are 'Done' and 'Cancel' buttons.

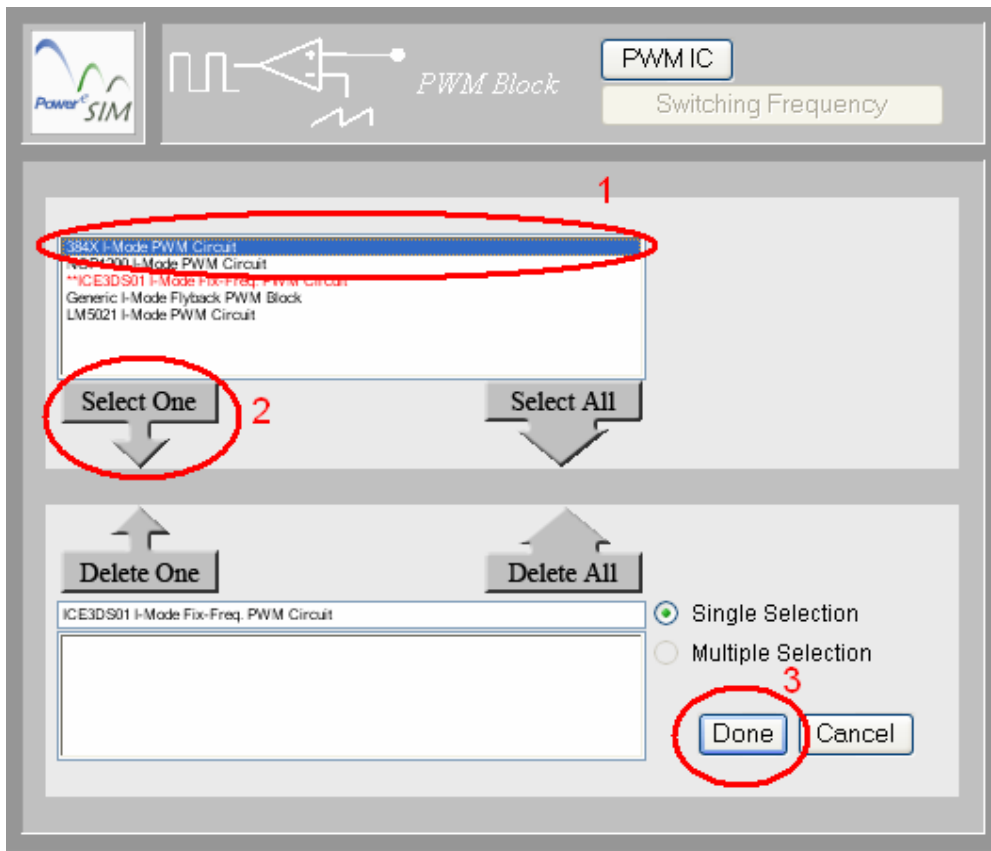
1. Highlight any one component from the list
2. Press “Component Characteristic”
3. A component characteristic page will be displayed.
4. If highlighted component is changed, press “Component Characteristic” again to refresh.

### 5.13 Select PWM Controller Block



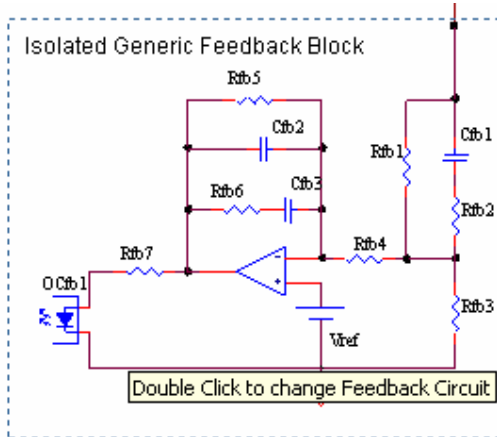
Double click the block in order to view the current PWM block

### 5.14 Change PWM Controller Circuit



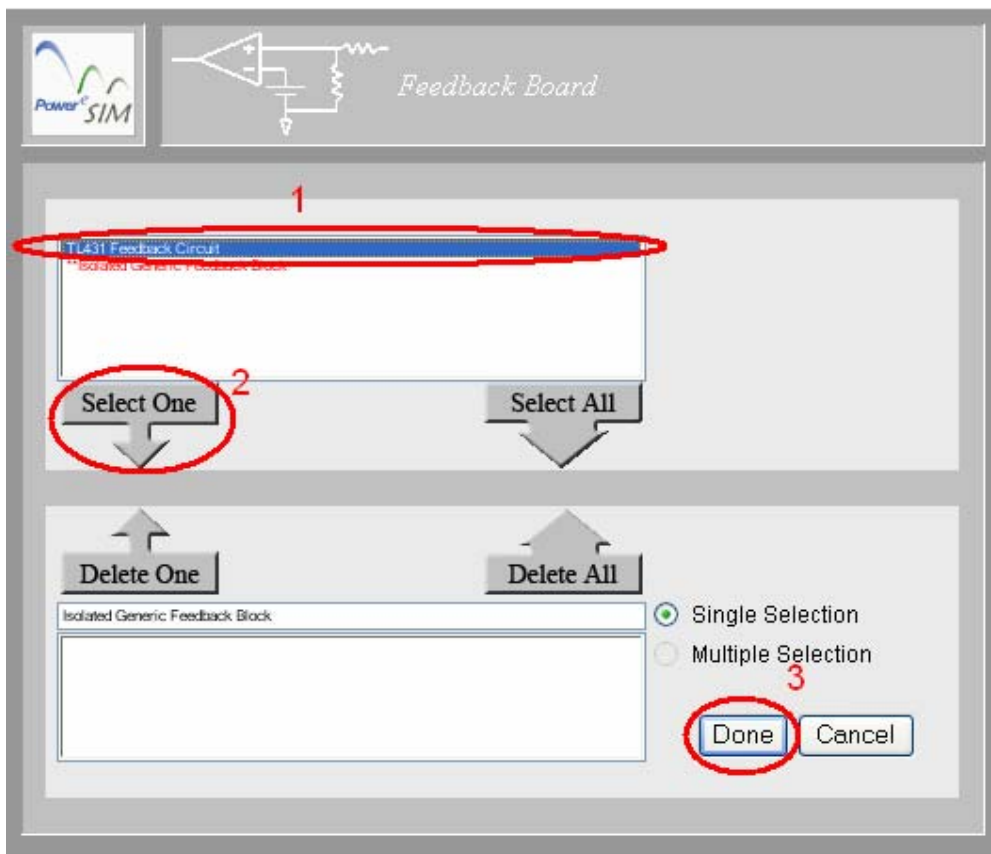
1. Highlight any one circuit from the list
2. Press “Select One”
3. Press “Done” after selection

## 5.15 Select Feedback Block



Double click the block in order to view the current Feedback block

## 5.16 Change Feedback Circuit



1. Highlight any one circuit from the list
2. Press "Select One"
3. Press "Done" after selection


### 5.17 Recalculate charts on the front page.

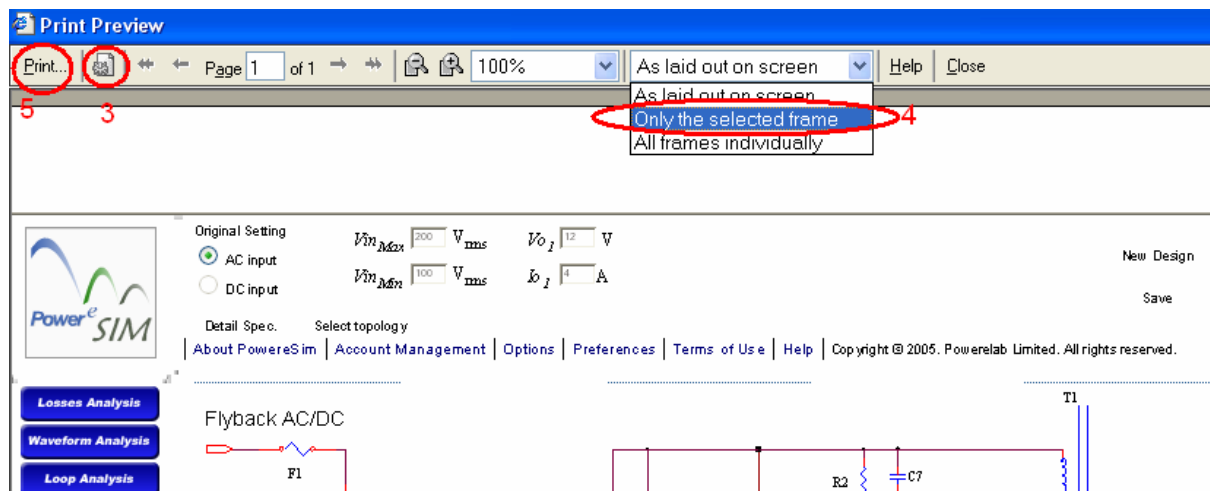


Press “Generate Charts” button

### 5.18 Print Schematic Diagram

To print the circuit diagram, there are several steps.

1. Use mouse and click on the circuit diagram ONCE.
2. If you are using Internet Explorer, choose File->Print Preview.
3. Click on "Page Setup"  and choose Orientation to be Landscape.
4. Choose "Only the Selected Frame" from the top menu.



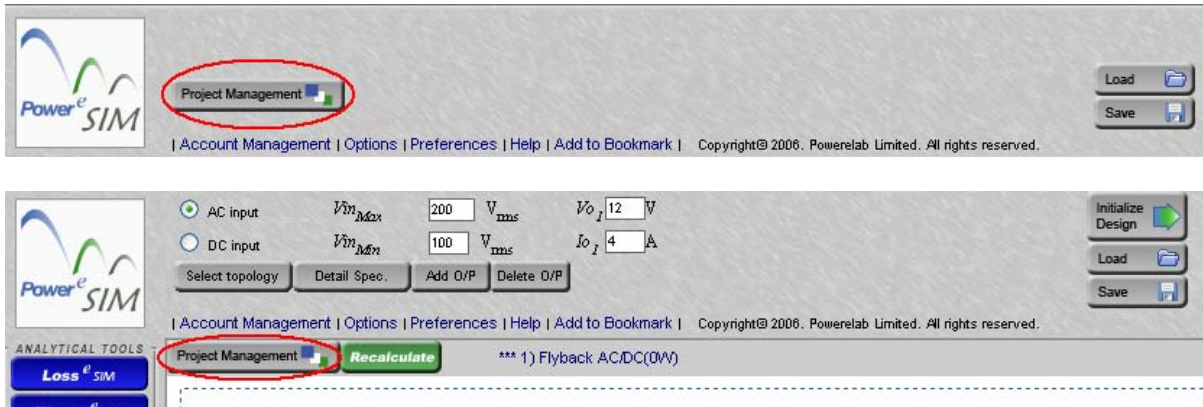
5. Finally click on “Print”



## 6 Project Management

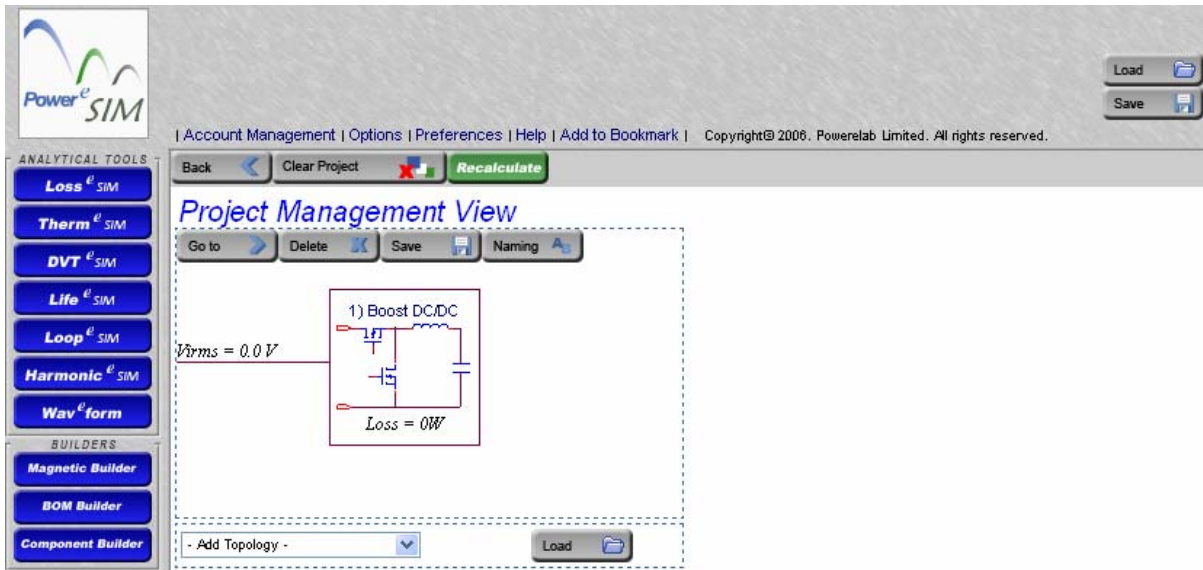
If you want to management more than one power supplies, Project Management Page can help you to manage the whole project.

### 6.1 Go To Project Management Page



You can go to Project management Page by clicking “Project Management” button

### 6.2 Project Management Page



### 6.3 Add Power Supply to Project

The screenshot shows the 'Project Management View' interface. At the top, there are buttons for 'Go to', 'Delete', 'Save', and 'Naming'. Below this, a circuit diagram for a '1) Boost DC/DC' converter is displayed. The input is labeled  $V_{rms} = 0.0 V$  and the output is labeled  $Loss = 0W$ . Below the circuit diagram, there are two red circles highlighting the '- Add Topology -' dropdown menu and the 'Load' button. To the right of the main interface, a list of power supply topologies is shown, including: Flyback AC/DC, Flyback DC/DC, RCC\_FLYBACK AC/DC, RCC\_FLYBACK DC/DC, Flyback Integrated PWM AC/DC, Flyback Integrated PWM DC/DC, Active Clamp AC, Active Clamp DC, PFC DCM, PFC CCM, Full Bridge AC/DC, Full Bridge DC/DC, Half Bridge AC/DC, Half Bridge DC/DC, Asym. Half Bridge AC/DC, Asym. Half Bridge DC/DC, Phase Bridge AC/DC, Phase Bridge DC/DC, Push Pull AC/DC, Push Pull Bridge DC/DC, 2W Forward AC/DC, 2W Forward DC/DC, Boost DC/DC, Buck DC/DC, Buck Boost DC/DC, Buck Sync DC/DC, and Generic. At the bottom of the list, there is another '- Add Topology -' dropdown menu.

There are two ways to add power supply

- Load from file
- Add new power supply
  - o “Add Topology” list box contains a list of topology. After select one topology, a new power supply is added

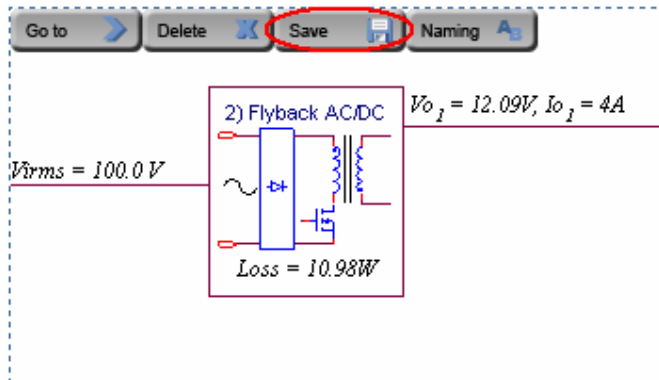
### 6.4 Delete Power Supply from Project

The screenshot shows the 'Project Management View' interface. At the top, there are buttons for 'Go to', 'Delete', 'Save', and 'Naming'. The 'Delete' button is highlighted with a red circle. Below this, a circuit diagram for a '2) Flyback AC/DC' converter is displayed. The input is labeled  $V_{rms} = 100.0 V$  and the output is labeled  $V_{o1} = 12.09V, I_{o1} = 4A$ . The loss is labeled  $Loss = 10.98W$ .

Press “Delete” button can delete power supply from project

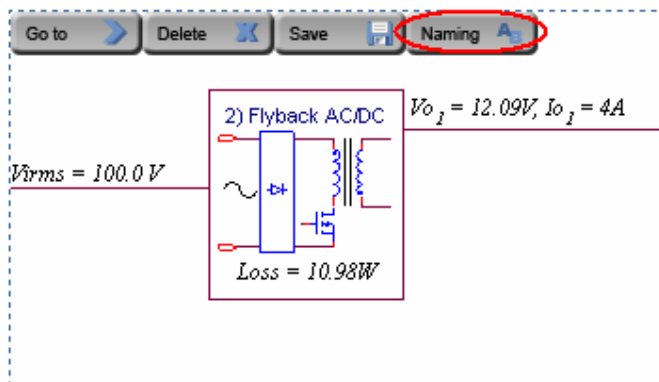


## 6.5 Save Power Supply

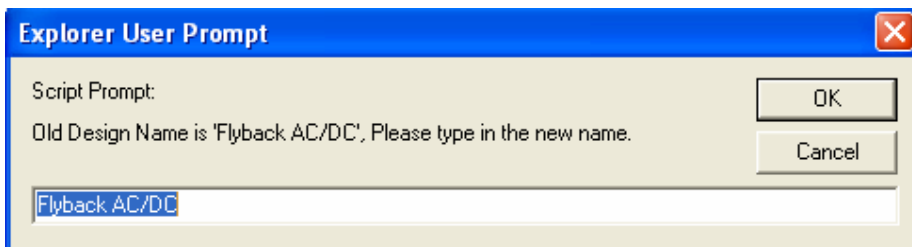


Press “Save” button can save power supply separately

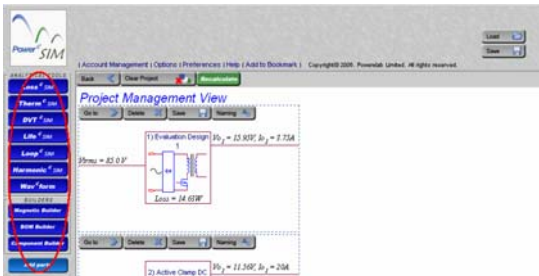
## 6.6 Naming Power Supply



Press “Naming” button will pop up a window and user can give the power supply a name



## 6.7 Project Summaries



In project view, a project summary is shown at the analyzing tools

### 6.7.1 Loss Analysis under project management status



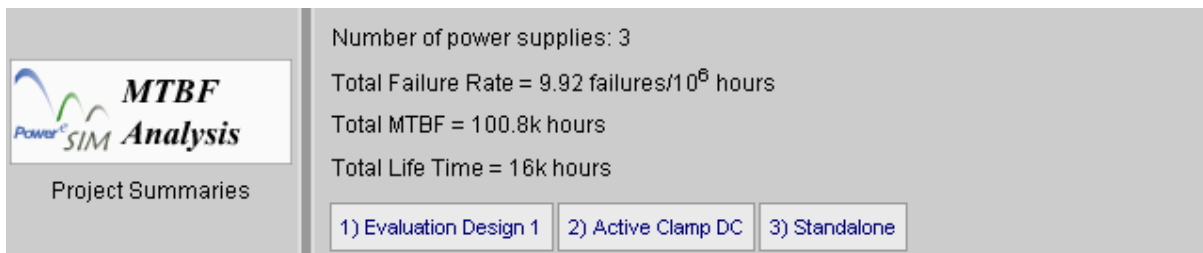
It shows the total losses for whole project and the loss for each power supply.

### 6.7.2 DVT Report under project management status



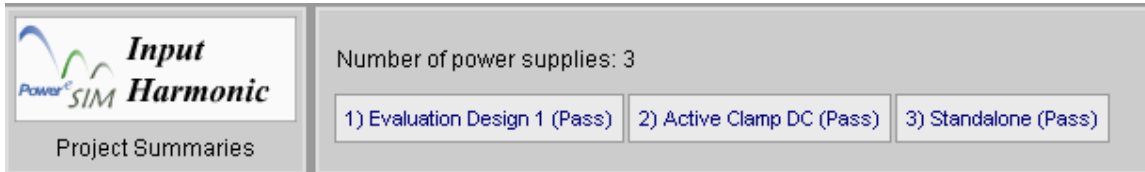
It shows the number of reject and warning message for whole project and each power supply.

### 6.7.3 MTBF Analysis under project management status



It shows the total failure rate, MTBF and Life Time for whole project.

#### 6.7.4 Input Harmonic under project management status



It shows the simulated result for each power supply.

#### 6.7.5 BOM & Vendor under project management status



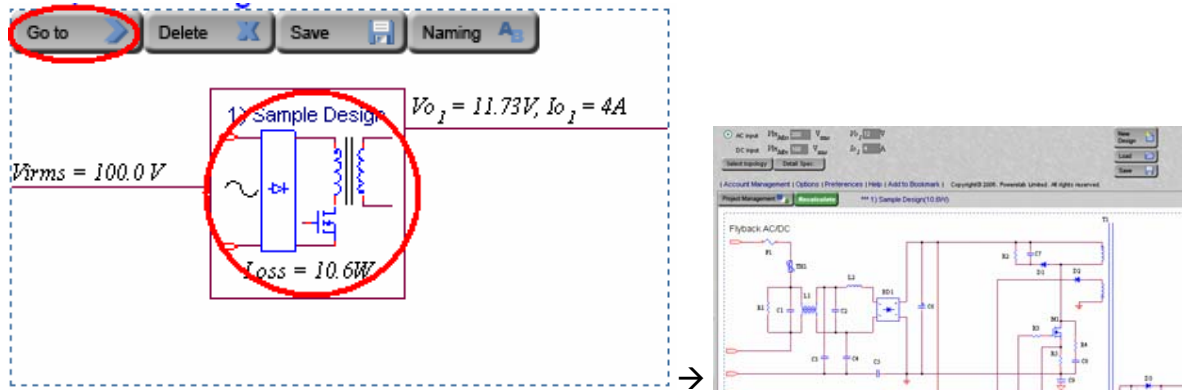
It shows the number of parts at BOM at whole project and each power supplies.

#### 6.7.6 Add Component under project management status



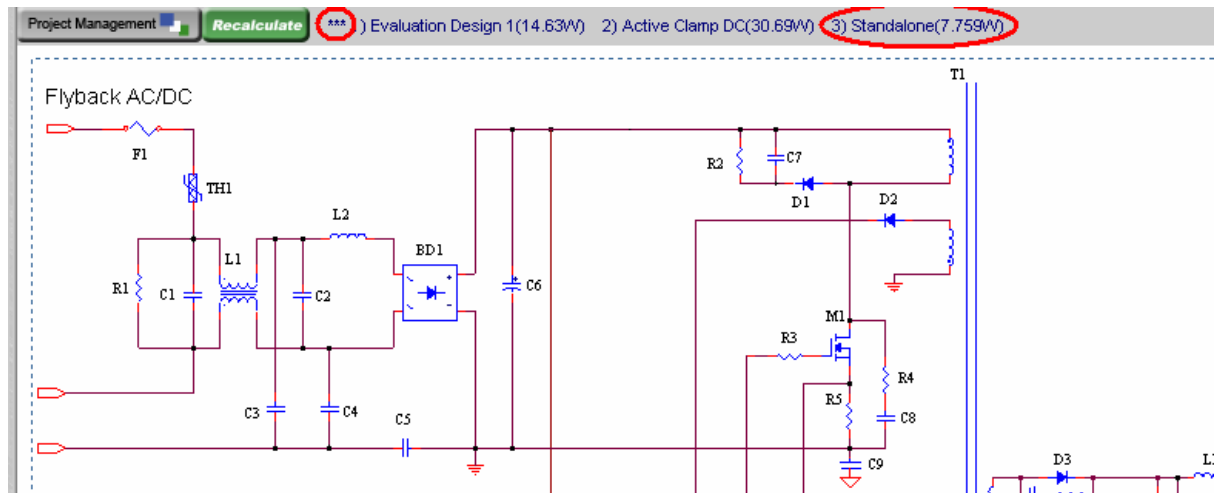
It shows the number of components that added separately for whole project and each power supplies.

### 6.8 Select Power Supply



Press "Go To" button or the circuit can select the power supply and switch to power supply view

### 6.9 Switch between Power Supply



In power supply view, you can view a project summary at the top. This project summary frame provides you a link. Press the link (the name of the power supply e.g. 3 Standalone) can switch to another power supply. Beside, the sign \*\*\* shows which is the current one.

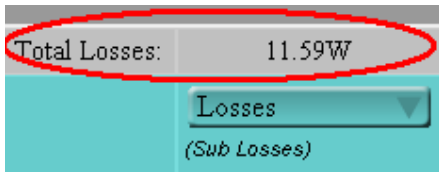
## 7 Analyzing Modules

### 7.1 Loss Analysis - Loss<sup>e</sup><sub>SIM</sub>

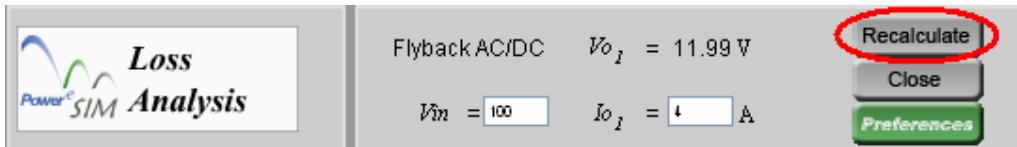
#### 7.1.1 What is Loss analysis?

Loss analysis may be the most useful tool of PowerEsim. It sort the losses of each component user added or automatically loaded from converter, and give a break down on what kind of losses they are. User can improve efficiency or cost by just choosing different component from different manufacturer.

#### 7.1.2 Most crucial parameter – Total Loss



#### 7.1.3 Instant update on the Total Loss after any change



User can change operating condition, e.g. input voltage, output current, and component and press “Recalculate” for new losses.

#### 7.1.4 Individual Component Loss shown

D3	BA 100V STPS8H100D STM TO220AC	2.415 W
	Conduction Losses	(2.415W)
	Switching Losses	(179.4uW)

A break down of losses is given for some component. User can have more information on how the losses of individual component come from.

#### 7.1.5 Conduction Loss

D3	BA 100V STPS8H100D STM TO220AC	2.415 W
	Conduction Losses	(2.415W)
	Switching Losses	(179.4uW)

For example, conduction losses of a diode means forward drop losses.

### 7.1.6 Switching Loss

<b>D3</b>	8A 100V STPS8H100D STM TO220AC	2.415 W
	<i>Conduction Losses</i>	<i>(2.415W)</i>
	<i>Switching Losses</i>	<i>(179.4uW)</i>

Switching losses of a diode means the sum of reverse recovery losses and reverse leakage current losses.

### 7.1.7 Fringing & Leakage Flux Loss

<b>T1</b>	Main Transformer	1.771 W
	<i>Core Losses</i>	<i>(435.8mW)</i>
	<i>Conduction Losses</i>	<i>(487.1mW)</i>
	<i>Fringing &amp; Leakage Flux Losses</i>	<i>(848.2mW)</i>


Losses of a magnetic component divided into three part, core losses means the total ac losses including the hysteresis and eddy current losses. “Conduction losses” means the dc copper losses. Fringing & leakage flux losses means the sum of all ac losses in the copper, e.g. ac losses caused by skin and proximity effect, eddy current losses caused by fringing flux, etc.

## 7.2 Waveform Analysis- Waveform

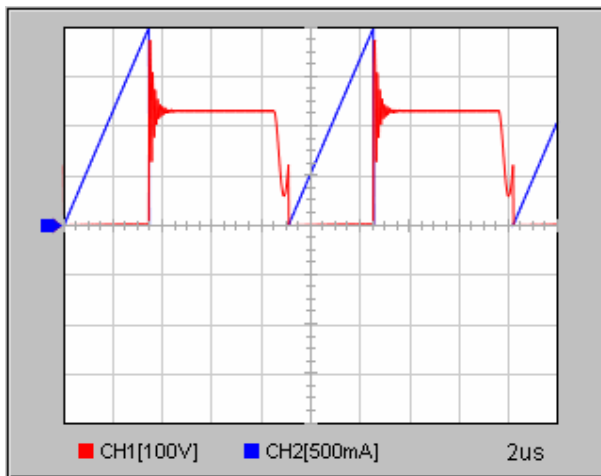
### 7.2.1 What is waveform analysis?

Waveform analysis typically plots voltage and current of important components at a specific operating condition.

### 7.2.2 How can I bring up the waveform analysis window?

Just press  on the left panel on the main page.

### 7.2.3 What are shown on these plots?




Here is a typical plot of a Flyback converter circuit with component M1. You have dual traces channel 1 (CH1) and channel 2 (CH2). Vertical resolutions are quoted inside the square brackets while the horizontal resolution resides on the bottom right.

### 7.2.4 Hey, what are these curves for?

Primary MOSFET switching waveform @  
 peak bulk voltage waveform  
 Ch1 - M1 drain source voltage waveform  
 Ch2 - M1 drain current waveform  
 Time Base - 2us/Div

A description box is placed on the right hand side of each waveform plot. It informs us which waveform is shown by each trace.

### 7.2.5 Can I change the operating condition?

Similar to other PowerEsim windows, you can change the input voltage as well as loading current to obtain an estimate of characteristics curves of certain components. All plots will be updated immediately after pressing  on the top panel.

## 7.3 Loop Analysis - Loop<sup>e</sup><sub>SIM</sub>

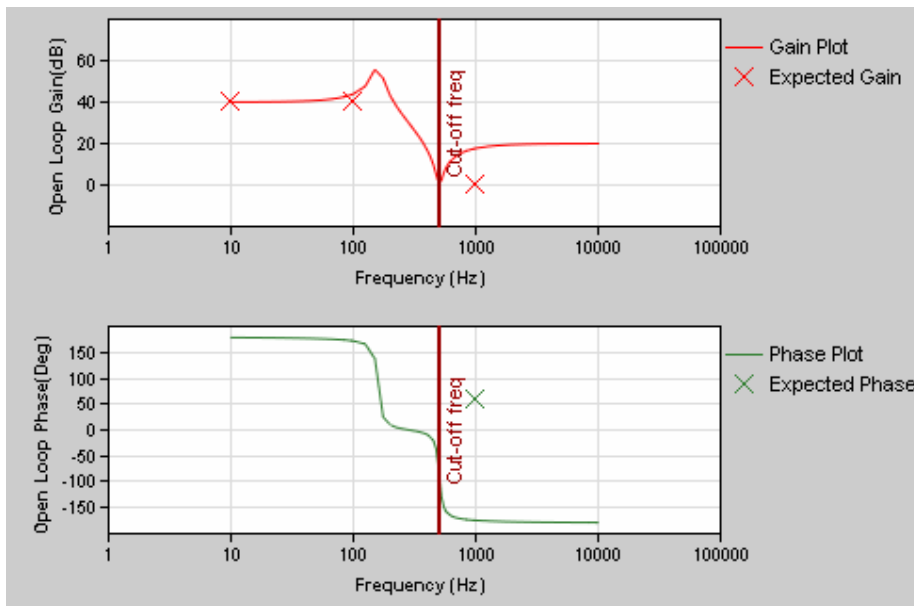
### 7.3.1 What is Loop analysis?

Loop analysis is a tool to let user arbitrary draw a transfer function by vary the coefficient or component from the feedback block. On the other way, curve fitting can be done by entering points of expected gain or expected phase, by pressing “Automatic Compensation” button, the coefficient of the transfer function or components will be changed to fit those points.

### 7.3.2 Loop Analysis with power supply initialized - Generic transfer function analyzer

$$G(s) = k \cdot \frac{a_0 + a_1 \cdot s + a_2 \cdot s^2 + \dots + a_i \cdot s^i + \dots + a_n \cdot s^n}{b_0 + b_1 \cdot s + b_2 \cdot s^2 + \dots + b_i \cdot s^i + \dots + b_n \cdot s^n}$$

The Loop Analysis provides the interface to customize the transfer function and shows the gain and phase of the transfer function G(s)





7.3.2.1 Change transfer function coefficients ( $a_i$  and  $b_i$ )

Automatic Compensation			
$n$	3	$k$	-100.0
$a_0$	1	$b_0$	1
$a_1$	-30u	$b_1$	100u
$a_2$	100n	$b_2$	1u
$a_3$	0	$b_3$	0
$a_4$	0	$b_4$	0
$a_5$	0	$b_5$	0

Apply

Input  $a_i$  and  $b_i$  with using this interface. You can set the number of parameters by setting  $n$ , where  $n$  is the order of the transfer function.

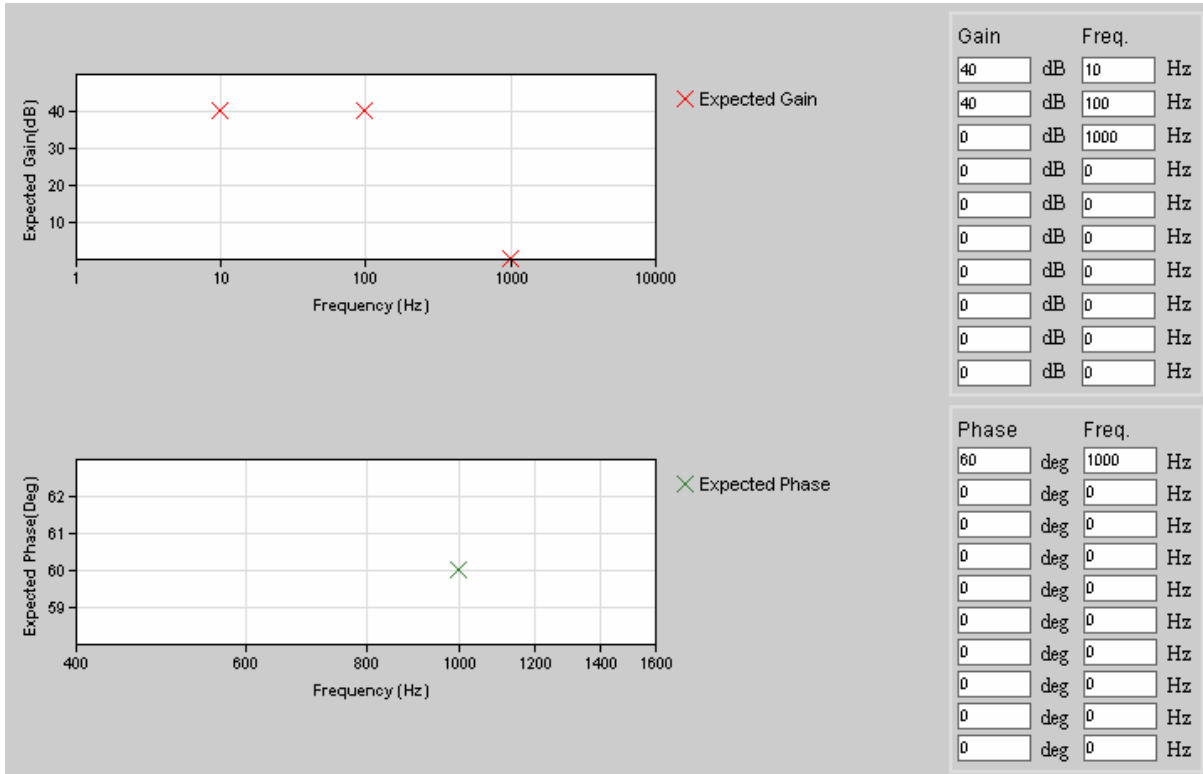
## 7.3.2.2 Define the range of each coefficient for Automatic Compensation

Range for automatic Compensation							
	Min.	Max.			Min.	Max.	
$a_0$	10m	100	<input checked="" type="checkbox"/>	$b_0$	10m	100	<input type="checkbox"/>
$a_1$	-3m	-300n	<input type="checkbox"/>	$b_1$	1u	10m	<input checked="" type="checkbox"/>
$a_2$	1n	10u	<input checked="" type="checkbox"/>	$b_2$	10n	100u	<input checked="" type="checkbox"/>
$a_3$	0	0	<input type="checkbox"/>	$b_3$	0	0	<input type="checkbox"/>
$a_4$	0	0	<input type="checkbox"/>	$b_4$	0	0	<input type="checkbox"/>
$a_5$	0	0	<input type="checkbox"/>	$b_5$	0	0	<input type="checkbox"/>

Compensation Setting      Automatic Compensation

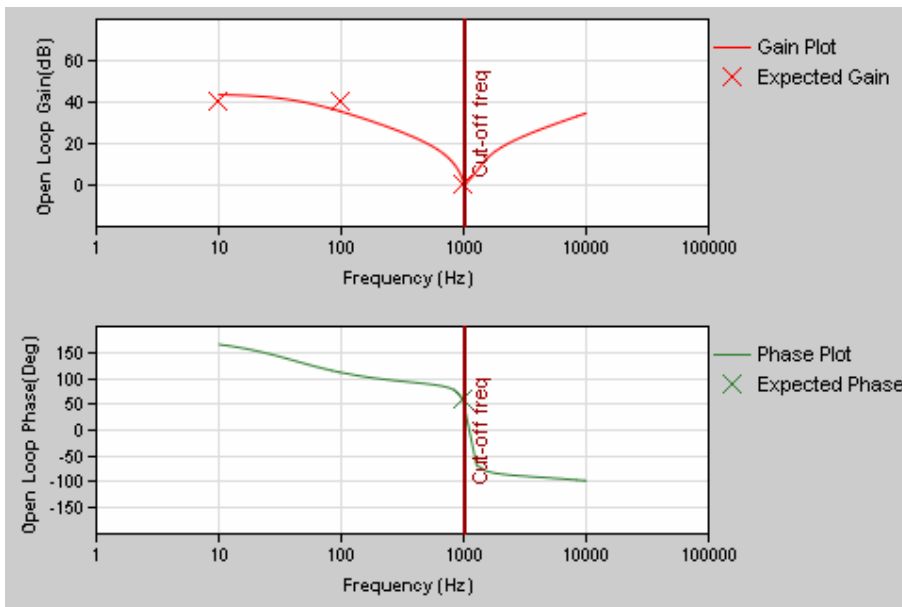
The range of  $a_i$  and  $b_i$  should be specified for curve fitting purpose. For coefficient which user may not want to be changed by our non-linear regression curve fitting engine, user simply unchecks the check box as shown above.

7.3.2.3 Draw any transfer function



Click on "Compensation Setting". You can set the expected Gain and Phase at different frequencies. Then, close this window and click on "Automatic Compensation"

7.3.2.4 Change after Automatic Compensation



After Automatic Compensation, a non-linear regression curve fitting will change  $a_i$  and  $b_i$  value so as to fit the expected gain and expect phase as close as possible. The adjusted  $a_i$  and  $b_i$  are shown at the parameter setting interface.

### 7.3.2.5 Tips on Automatic Compensation

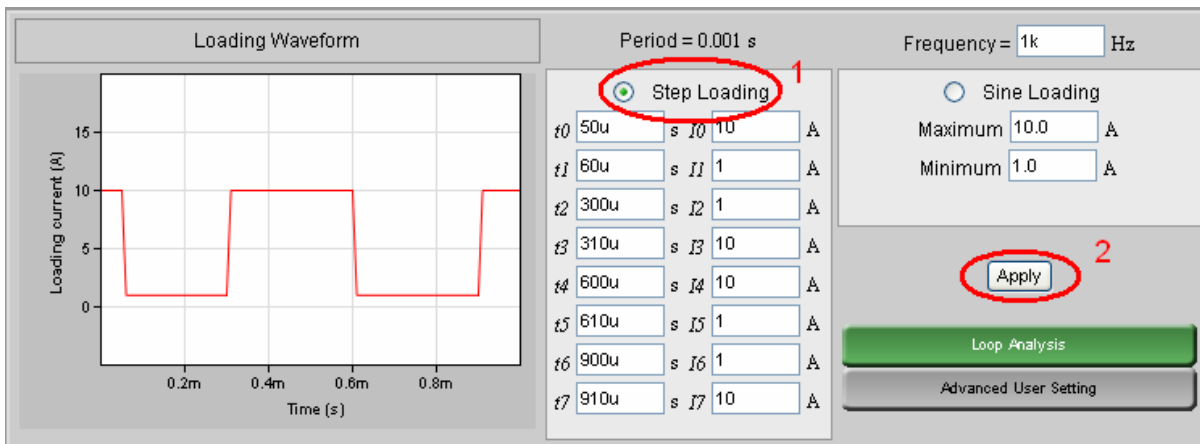
How well the transfer function fit all those points depends on the number of  $a_i$  and  $b_i$  allowed to change and the range of  $a_i$  or  $b_i$

### 7.3.2.6 Non-linear Load Transient Analysis



Non-linear load transient analysis can be done by pressing “Transient Analysis.” The voltage waveform will be displayed according to the loading current shape and output impedance defined by user.

### 7.3.2.7 How to set the Step loading in Transient Analyzer?



The screenshot shows the Transient Analyzer interface. On the left, a graph titled "Loading Waveform" displays a step current waveform. The y-axis is "Loading current (A)" ranging from 0 to 15, and the x-axis is "Time (s)" ranging from 0 to 0.8m. The waveform starts at 10A, drops to 0A at 0.1m, rises to 10A at 0.3m, drops to 0A at 0.6m, and rises to 10A at 0.8m. On the right, the configuration panel is set to "Period = 0.001 s" and "Frequency = 1k Hz". The "Step Loading" radio button is selected and circled with a red circle and the number 1. Below it, a table lists current steps:

t	Current (A)	Duration (s)
t0	50u	10
t1	60u	1
t2	300u	1
t3	310u	10
t4	600u	10
t5	610u	1
t6	900u	1
t7	910u	10

The "Apply" button is circled with a red circle and the number 2. Other options include "Sine Loading" with "Maximum" and "Minimum" current values, and buttons for "Loop Analysis" and "Advanced User Setting".

In Transient Analysis

1. Click the step loading current with this interface, enter the turning point of the loading current  $I_i$  against  $t_i$ .
2. Press on “Apply” to make it effective.
3. The arbitrary current loading current will be repeated at a rate defined by “Frequency” at the upper right corner.

### 7.3.2.8 How to set the Sine loading in Transient Analyzer?

The screenshot shows the 'Loading Waveform' window with a graph of 'Loading current (A)' vs 'Time (s)'. The graph displays a sine wave oscillating between approximately 1A and 10A. To the right, the configuration panel is set to 'Sine Loading' (indicated by a red circle and '1'). The 'Frequency' is set to '1k' Hz. The 'Maximum' current is set to '10.0' A and the 'Minimum' current is set to '1.0' A. The 'Apply' button is also circled in red and labeled '2'. Below the configuration panel are buttons for 'Loop Analysis' and 'Advanced User Setting'.

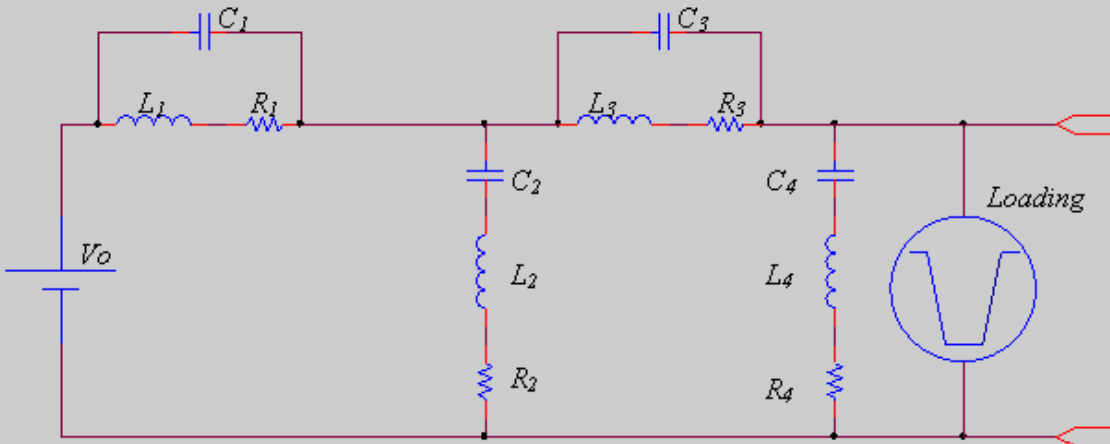
1. Check the “sine loading” selection and set the upper and lower limit of sine loading.
2. Press on “Apply” to make it effective.
3. “Maximum” means the peak current of the sine wave loading
4. “Minimum” means the lowest current of the sine wave loading.

### 7.3.2.9 What does the curve tell?

The screenshot shows the 'Transient O/P Waveform' window. It displays two waveforms: a red waveform (CH1) representing 'Output Loading Current' and a blue waveform (CH2) representing 'Output ac Transient Voltage'. The red waveform is a sine wave with a peak of 5A. The blue waveform is a sine wave with a peak of 50mV. The time base is set to 200us. To the right, the 'Measurement' section shows the following settings: 'Ch1 - Output Loading Current - 5 A/Div', 'Ch2 - Output ac Transient Voltage - 50mV/Div', and 'Time Base - 200us/Div'.

Once apply is clicked. AC voltage change and the response also can be seen on the setting at "Advance User Setting"

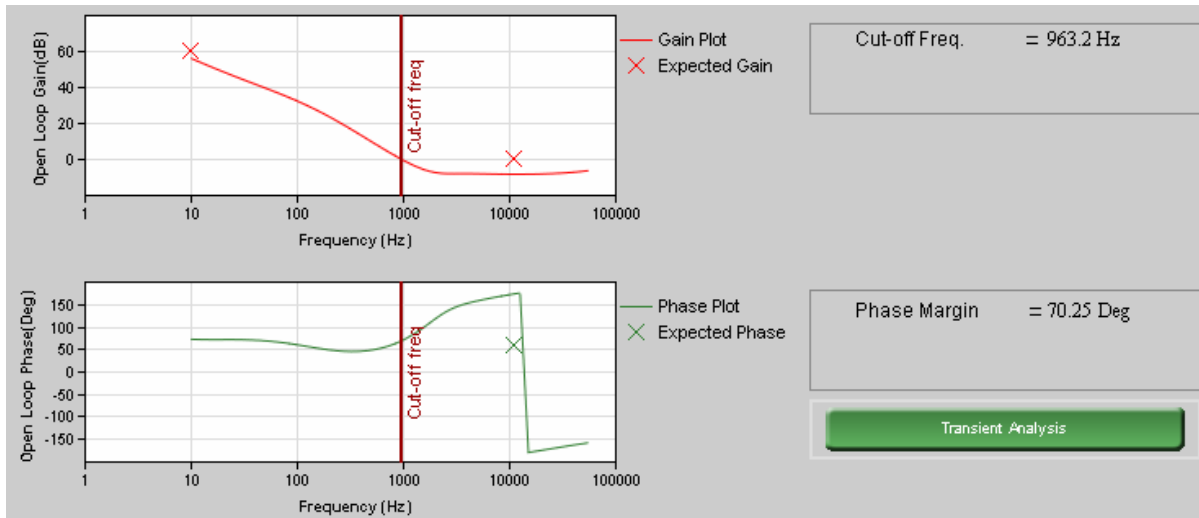
## 7.3.2.10 Advance User Setting in Transient Analyzer



Output Impedance	Output Capacitor	Output Inductor	Loading Capacitor
$R_1$ 0.01	$R_2$ 0.1	$R_3$ 0.01	$R_4$ 0.01
$C_1$ 1.0E-12	$C_2$ 1.0E-12	$C_3$ 1.0E-12	$C_4$ 1.0E-4
$L_1$ 1.0E-6	$L_2$ 1.0E-12	$L_3$ 5.0E-7	$L_4$ 1.0E-7
Max. positive supply current 13.0			
Min. negative supply current 0.0			

After Click on "Advance User Setting" at Loading Setting, You can set the output impedance of a generic power supply by setting "Output Capacitor", "Output Inductor", "Loading Capacitor", "Max. positive supply current" and "Min. negative supply current" to customize the generic power supply characteristic.

### 7.3.3 Loop Analysis with power supply initialized



After initializing a power supply design, the loop analyzer will take the open loop transfer function of the power supply user chosen. Current injection method is employed for small signal analysis, all the detail parasitic element, e.g. ESR, ESL, ESR vs Temp. and high frequency effect, are already considered. User no longer needs to do the tedious analysis.

#### 7.3.3.1 Automatic Compensation - optimizing gain and phase margin

The screenshot shows the 'Automatic Compensation' dialog box with the following settings:

- Expected DC Gain: 60 dB
- Expected Phase Margin: 60 Deg
- Expected Cut-off Freq.: 11000 Hz

Buttons for 'Automatic Compensation' and 'Compensation Setting' are visible at the bottom.

User can set the Expected Gain Margin, Expected Phase Margin and Expected Cut-off Frequency of the power supply and press “Automatic Compensation” for the machine to find proper component to fit those points.

Use Advanced Setting

Gain	Freq.
60 dB	10 Hz
0 dB	11000 Hz

Or user can go into the “Compensation Setting,” click the check box “Use Advanced Setting” and enter point by point of the expected gain and expected phase. Go back and click on the "Automatic Compensation" our machine will try to provide the corresponding feedback component which will best fit user defined points.

### 7.3.3.2 How can feedback components be changed?

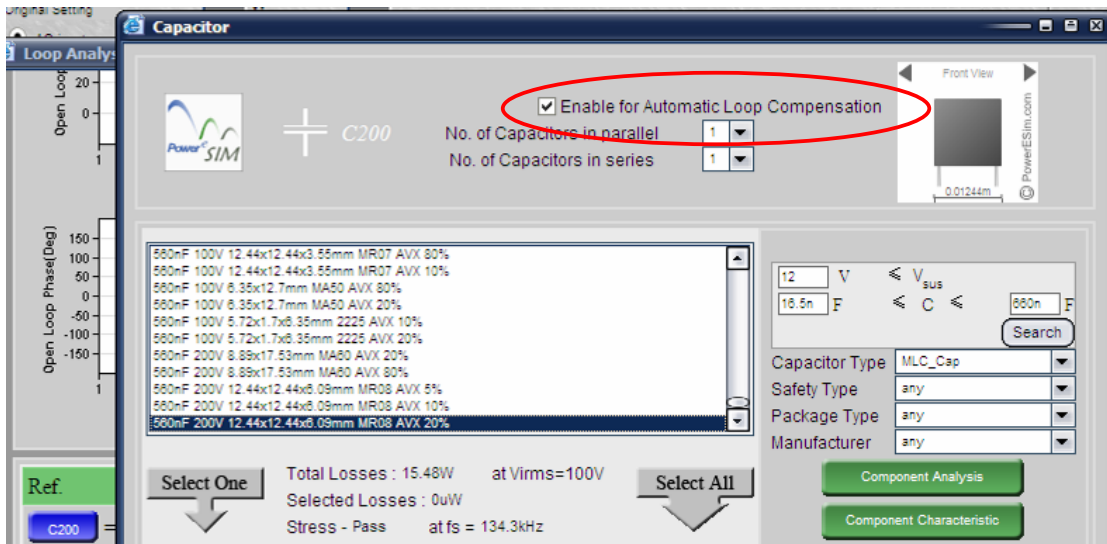
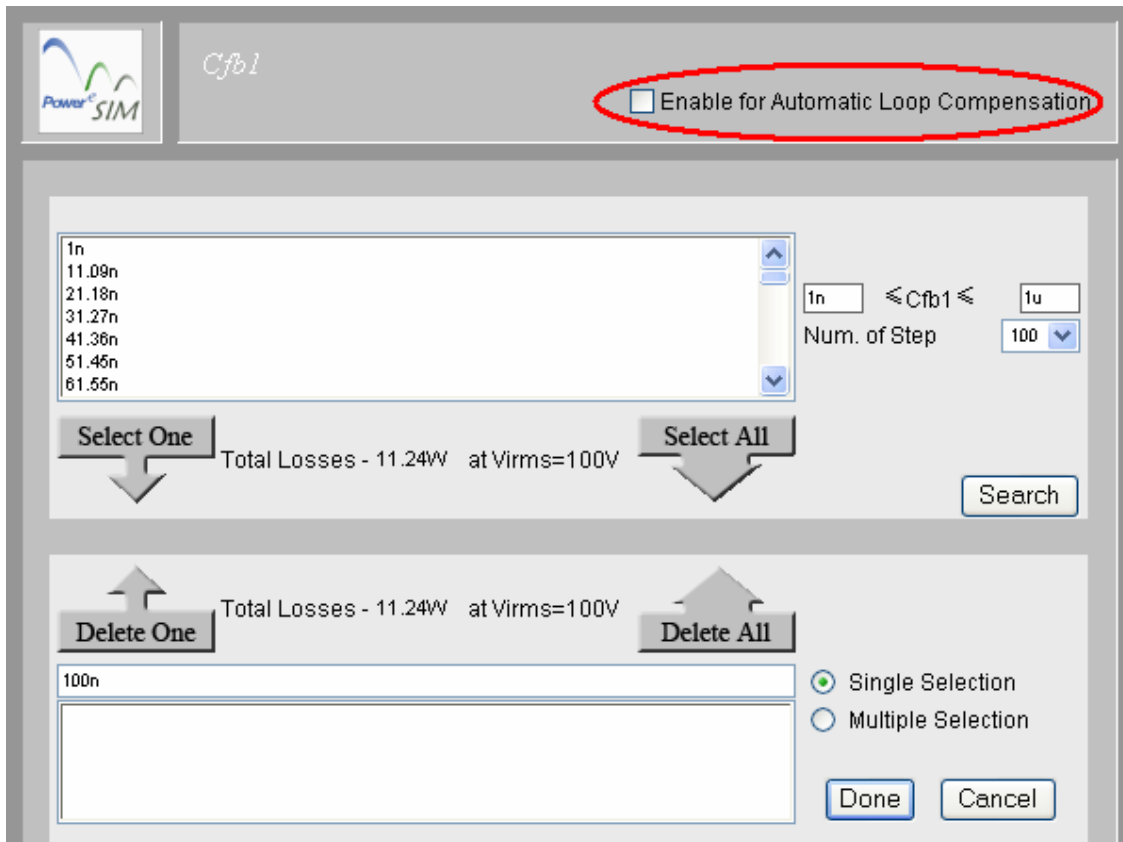
For example, if you choose the Generic Feedback circuit, the parts in the circuit are modeled as values such as capacitance or resistance. You can change particular values from the generic component page.

Ref.		Min.	Max.
<input checked="" type="checkbox"/> Cfb1	= 100n	1n	1u
<input type="checkbox"/> Cfb2	= 1n	100p	100n
<input type="checkbox"/> Cfb3	= 100n	1n	10u
<input type="checkbox"/> Iso	= 1	1	1
<input type="checkbox"/> Rfb2	= 10k	1k	100k
<input type="checkbox"/> Rfb6	= 1k	10	100k

Click on the component button and then you can see the following page. Uncheck the checkbox if you don't want the component used for automatic compensation.

Not every component are allowed for automatic compensation, only the component with a check box “Enable for Automatic Loop Compensation” at the upper right corner of component selection user interface.

7.3.3.3 Define the range of each component for Automatic Compensation



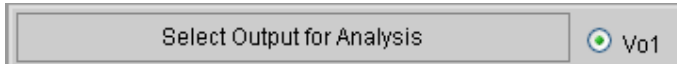
The range of the component used for automatic loop compensation is all component listed in the searched components box which is defined by the searching criteria.



#### 7.3.3.4 What bases do the transient analysis work?

The transient analysis is based on the small signal close loop transfer function to derive equivalent output impedance. Non-linear effect caused by the limitation of sink and source current have also considered.

#### 7.3.3.5 Corresponding transient response



You can select the output that you would like to monitor the transient response.


## 7.4 Thermal Analysis - Therm<sup>e</sup><sub>SIM</sub>

### 7.4.1 What is thermal analysis?

Thermal analysis is a tool to let user to place component, PCB, heatsink, etc. and enter the losses of each component. With just a click and wait for a few second the thermal result will be displayed. User can treat it as a standalone tool to estimate the thermal behaviors of any product. If a power supply has initialized, all the component with its corresponding losses of the power supply will be automatically transfer and synchronous to the thermal analysis tool.

The thermal simulator considers the conduction effect, convection effect as well as radiation effect.

### 7.4.2 How to start the Thermal Analysis?

Click on the  at the left main menu to start Thermal Analysis

### 7.4.3 Interface Requirement(s) for viewing Thermal Analysis?

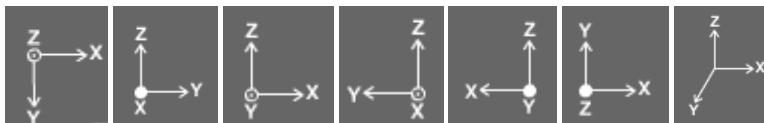


This Thermal Analysis Interface is developed using the Macromedia Flash MX 2004 and JavaScript 2.X. In order to view the plots, Flash Player 7.0 or above should be installed in your computer. The suggested web-browser is Internet Explorer 6.X on the Windows platform.

### 7.4.4 It is a 2D and 3D Thermal Analyzer



There are 8 views at Thermal Analyzer.



At the left top corner, you will see the following sign to indicate the type of current view.

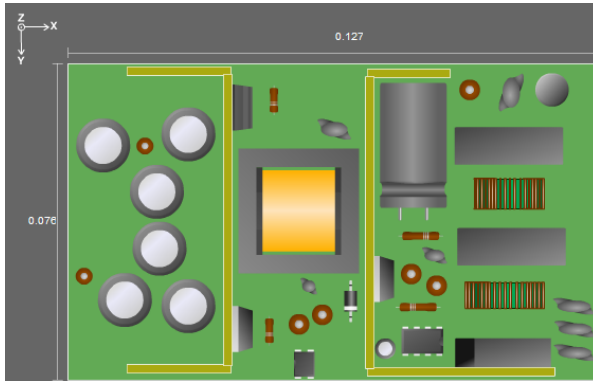


Figure: Normal Top view



Figure: Normal Bottom view

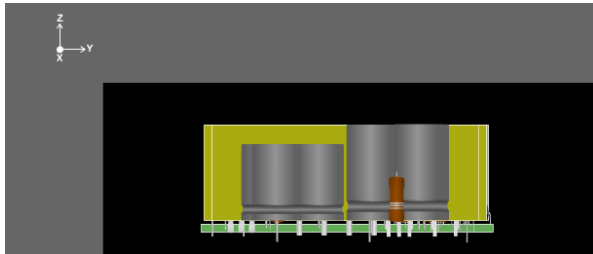


Figure: Left view

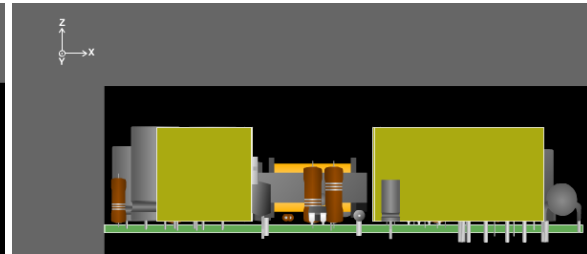


Figure: Front view

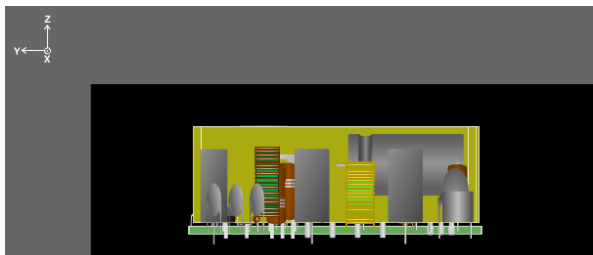


Figure: Right view

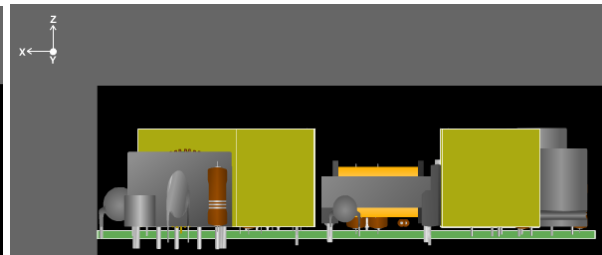


Figure: Back view

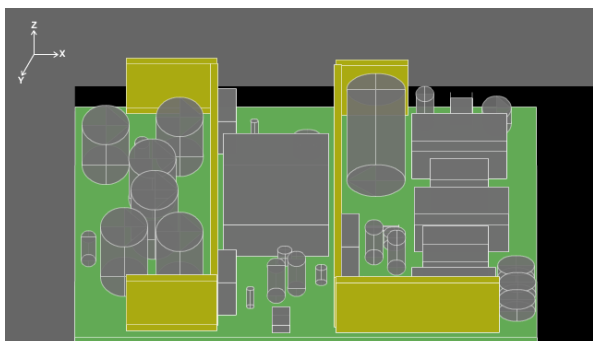


Figure: 3D view

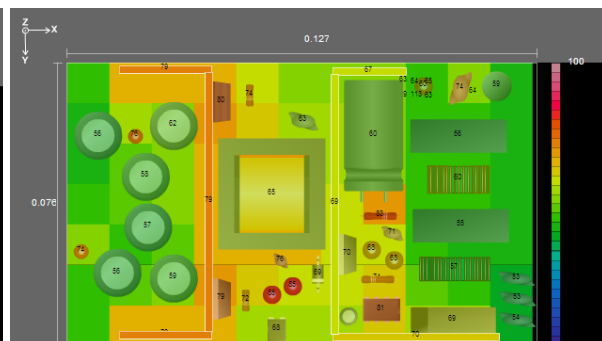


Figure: Thermal view

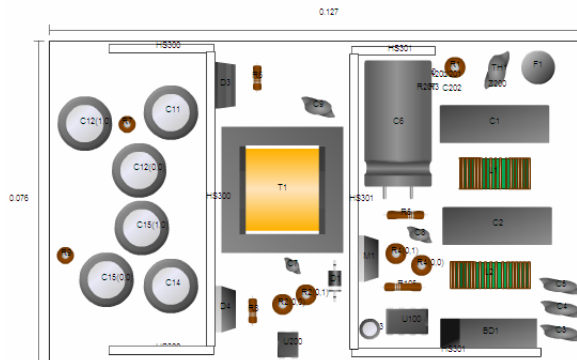
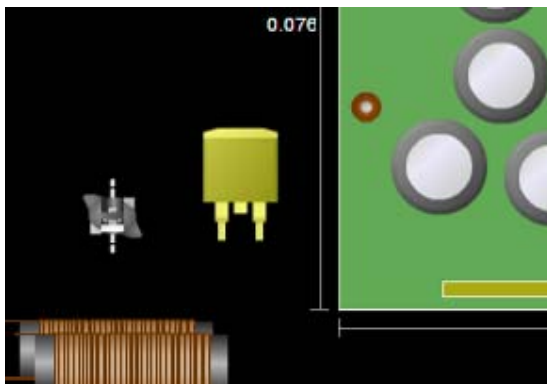


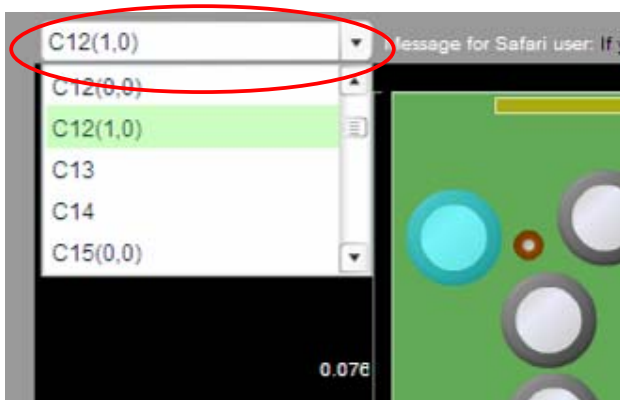
Figure: Print view

### 7.4.5 Place a part





Use the mouse to drag the component into the working area.

### 7.4.6 How to find a part by designator?



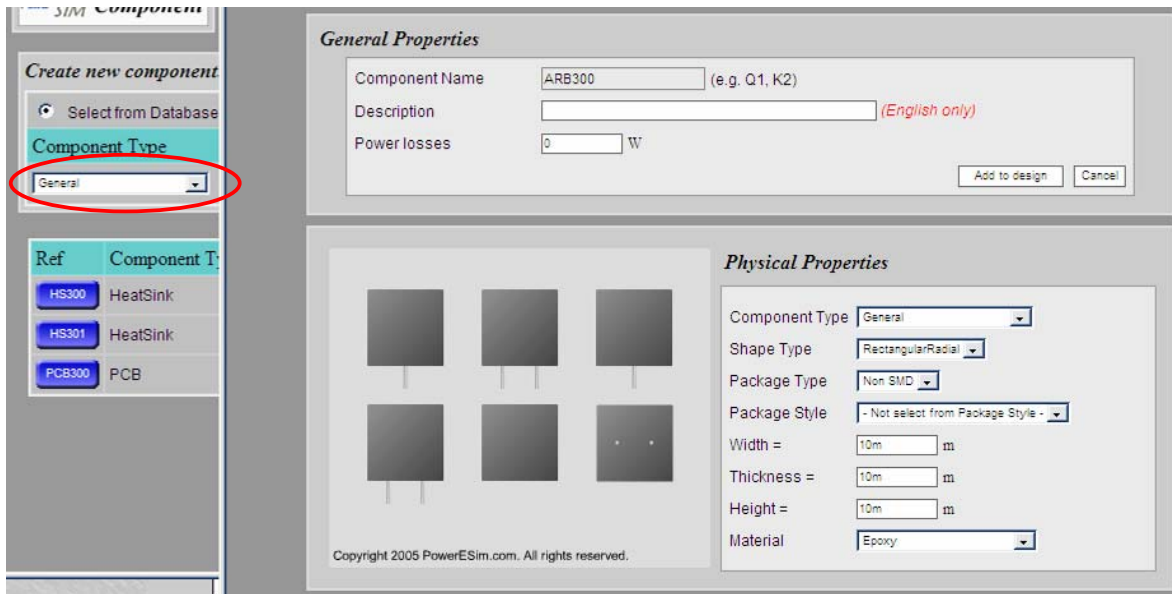
Select the part designator from the selection box. The part will be highlighted with cyan overlay.

#### 7.4.7 How to add a part for thermal simulation?

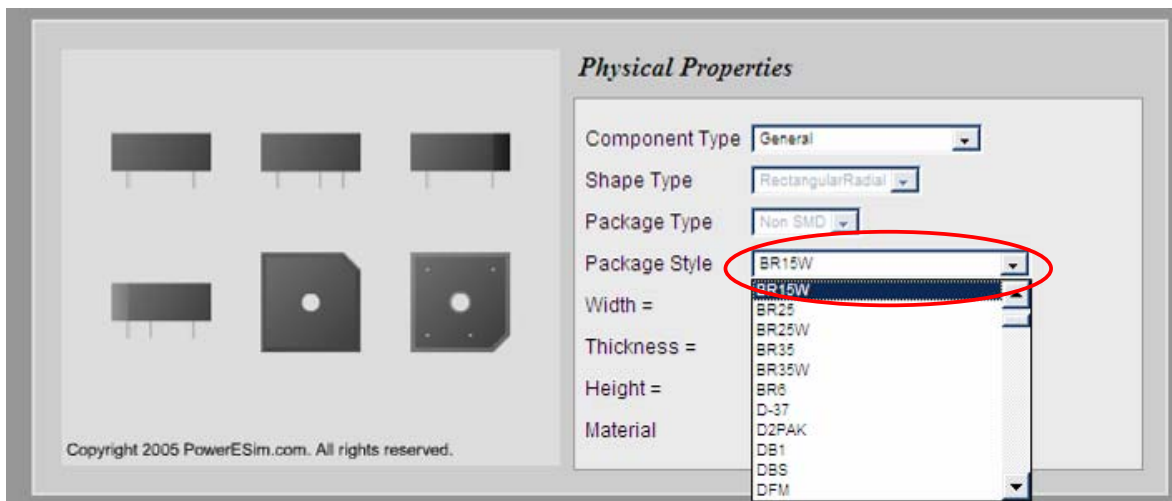
You can add parts for thermal simulation. Click on  and add a part from database or create a part of your own. You can also add a part by  at the top of Thermal Analysis page.

If the added part is selected from database, all the thermal parameter has been already model, user are only needed to enter the power losses.

To add part from database, select component type at the combo box below. Click “Add”. The component page pops up.



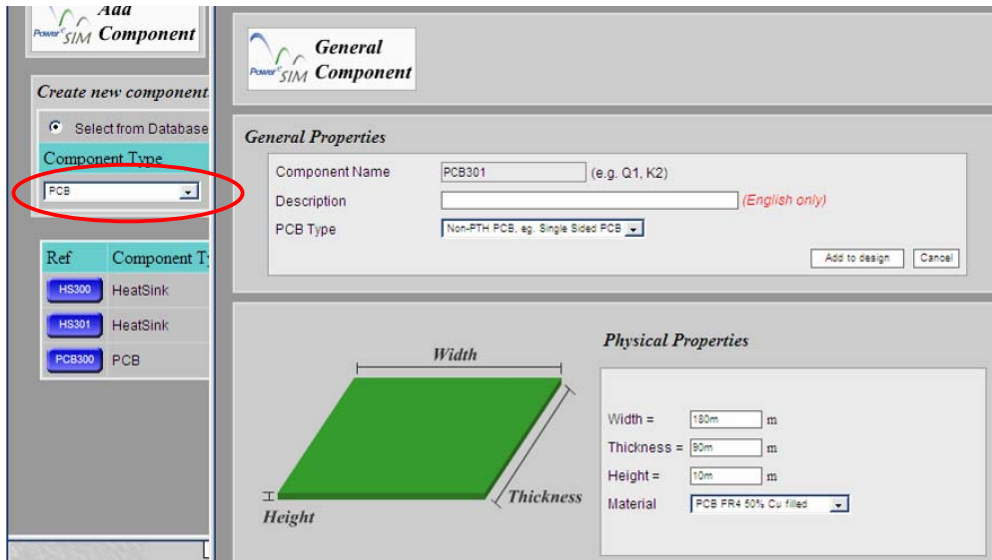
To customize the part, select “Customized Component” at the combo box “Component Type” or Click “Add”. The generic component page is popped up. You can input the shape and dimension of the part. The size and shape will be previewed at the left hand side. The material of the part is also needed.



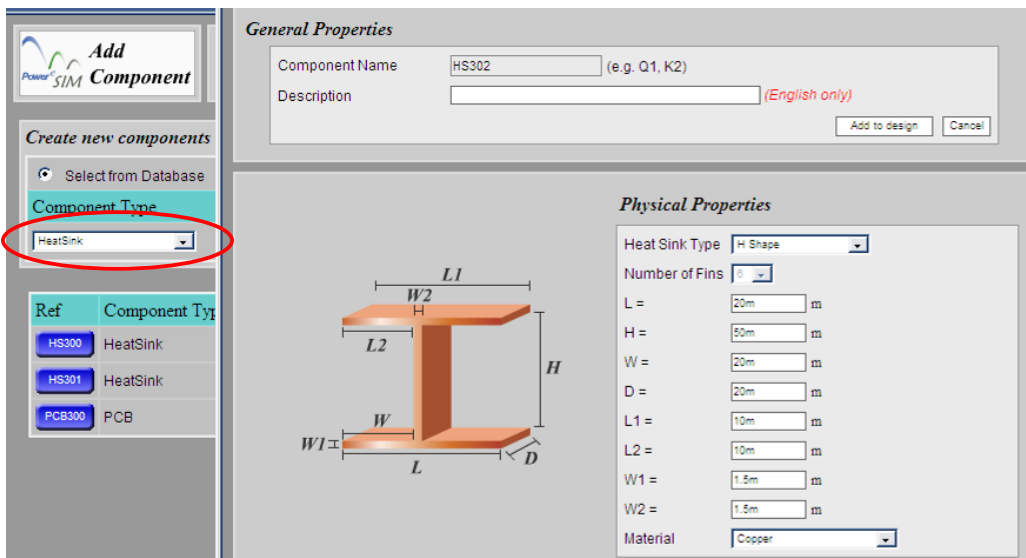
A lot of predefined package have been build to facility user. User can select the package style of the part from “Package style” combo box. The size and shape will be previewed at the left hand side. This shape will be as same as in Thermal Analyzer. No hand drawing is needed.

### 7.4.8 Printed Circuit Board PCB and heat sink can also be added

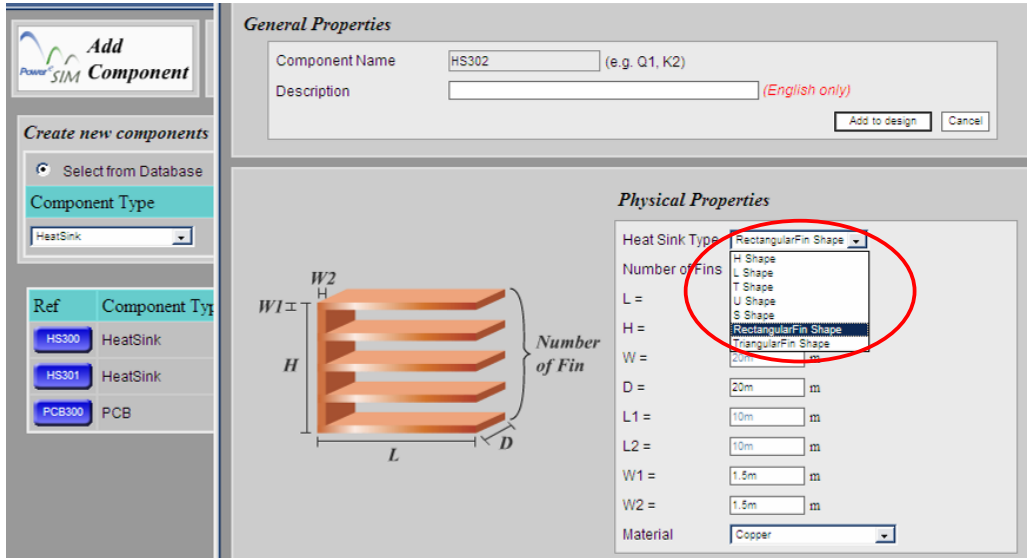
After initializing the power supply design, there are a PCB and a Heat sink. The first PCB added to the design is defined as the main PCB. It cannot be moved by dragging.



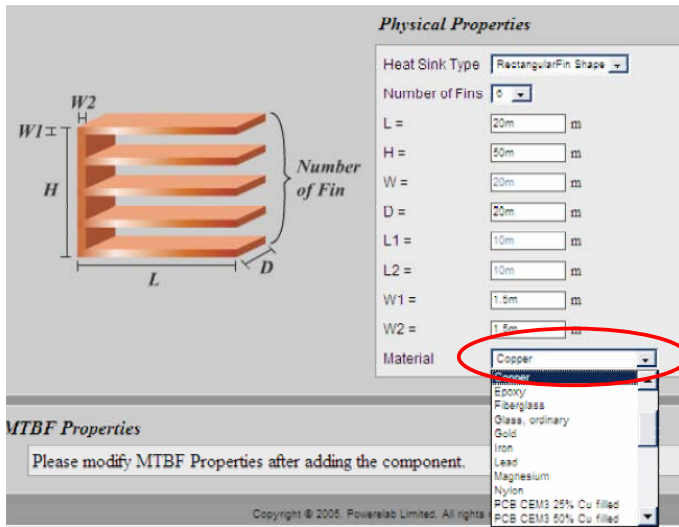
To add the PCB, select “PCB” at the component type combo box and click “Add”. You can customize the size and the material of the PCB.



To add the heat sink, select “HeatSink” from the Component Type and click “Add”. You can customize the shape, dimension and material of the heat sink.



User can select the basic form of the heat sink from “Heat Sink Type”

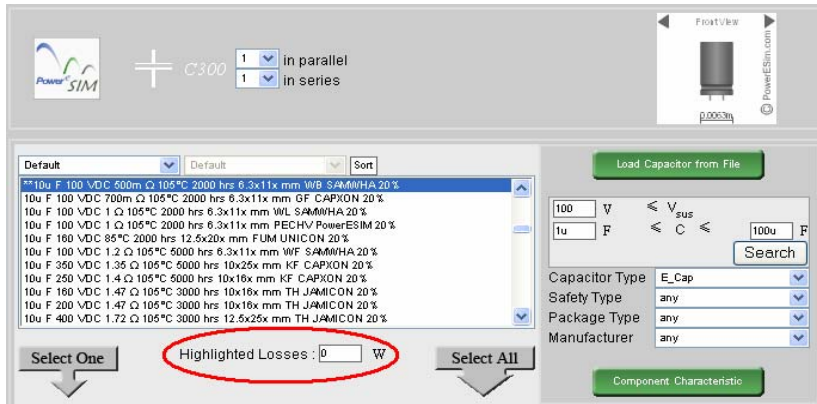


User can change the material of the heat sink from “Material”

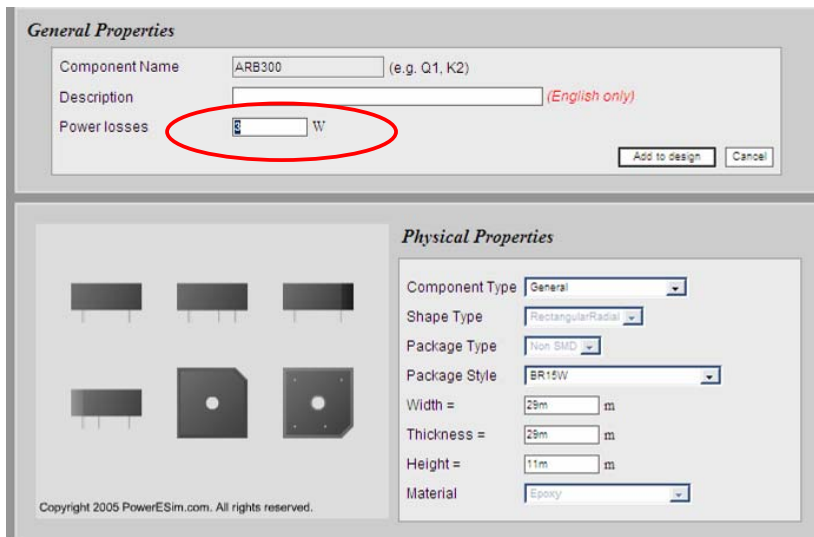


### 7.4.9 Defining Highlighted Losses of added parts

For any added parts, you can set their power losses. Heat sink and PCB are not allowed to set power losses.




If the added part is selected from database, the component selection user interface will provide a text box “Selected Losses” for user to enter the losses of that component

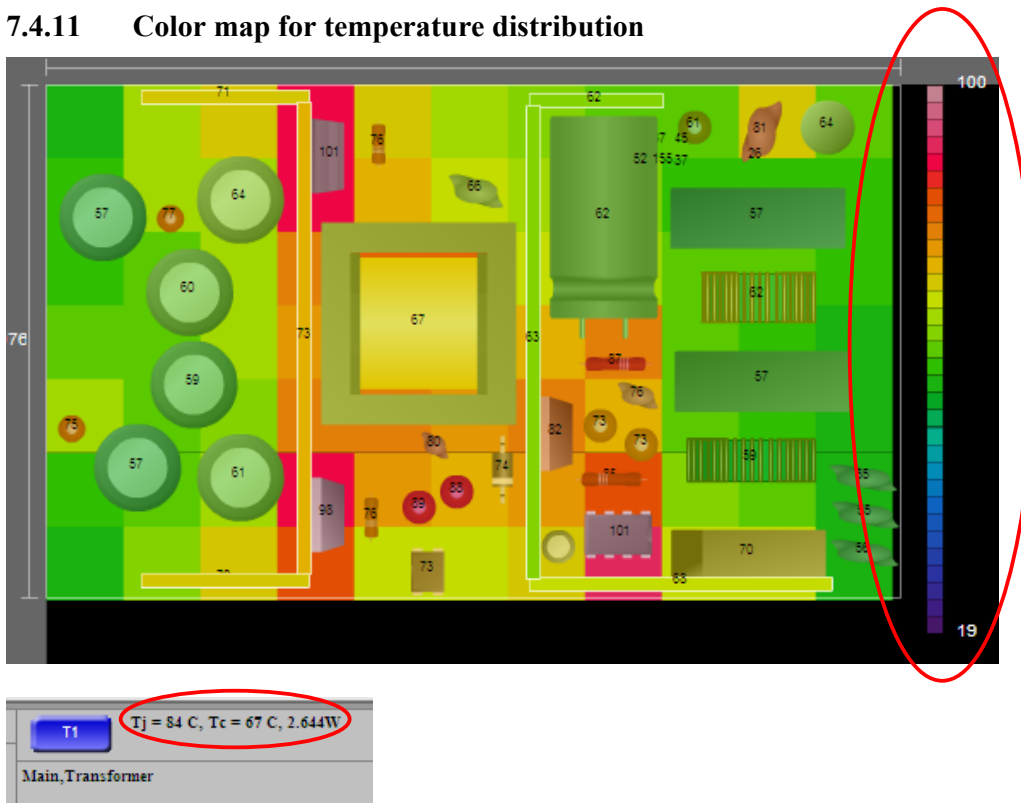


If the added part is customized, user has to enter the losses of that component at the “General Properties” page.

### 7.4.10 Start thermal simulation

After placement of components on the working area, you can start the thermal simulation by triggering with the button  shown. After a few seconds (duration depends on number of components and the size of PCB and heat sinks), the color of the component is changed according to the temperature.

### 7.4.11 Color map for temperature distribution



There is a color bar on the right hand side of the main PCB. Place the mouse pointer over the bar. The defined temperature value is shown. To get the temperature of each component, click on it and its Junction and Case temperatures appear at the bottom of the working area.

### 7.4.12 How to get and update the physical location of parts after placement?

The physical location of particular part is indicated at the left bottom. You can type in the location of the selected component and click “Update” to set the location.

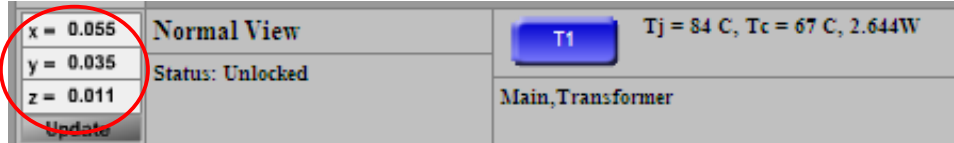


Figure: component location

### 7.4.13 How to view or edit a part at Thermal Analyzer?

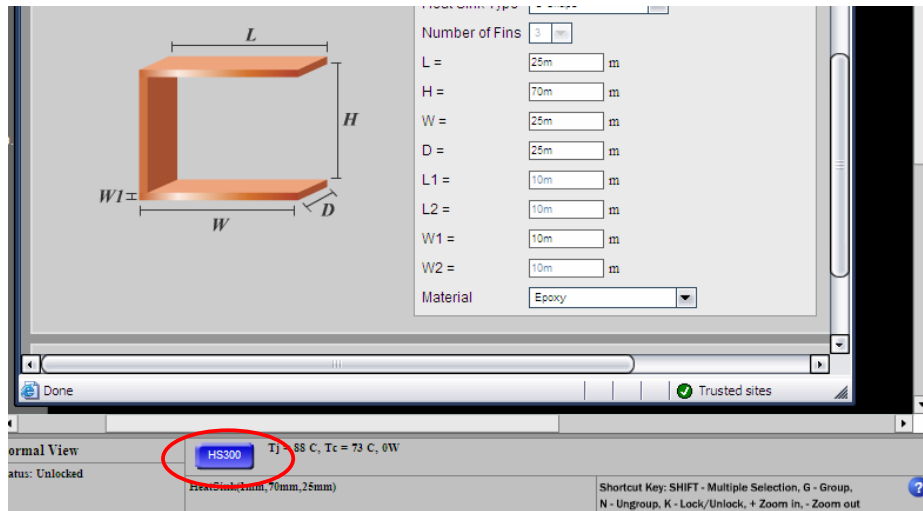


Figure: Link to component page

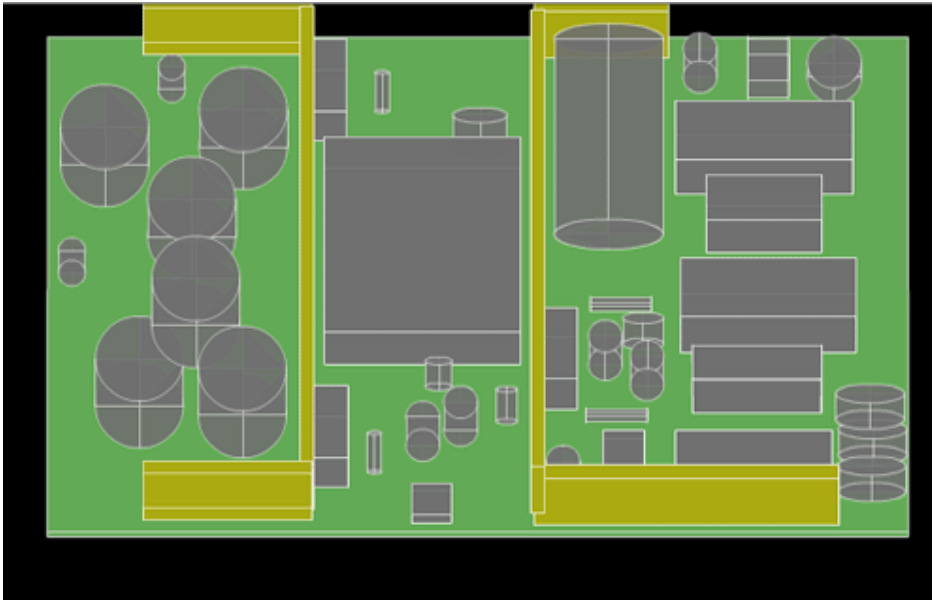
Select a component on the Thermal Analyzer. The designator will be appeared on the blue button on the interface. Click and view the part in component page.

### 7.4.14 Different thermal results at different combinations of $V_{in}$ and $I_{out}$



At the top bar, you can change the  $V_{in}$  and  $I_o$  of the power supply. Click on “Recalculate” to update the changes.

#### 7.4.15 How to turn the board to 3D view?



After triggering the 3D view, the position of the components is locked. You can drag the working place to upward and downward to turn the board.

#### 7.4.16 Create different package style of components

The shape of component appears at the Thermal Analysis. Interface is defined by following criteria:

1. The package style of the component (e.g. TO220). We have prepared about 200 common package styles in the database.
2. If the component does not have package style provided or its package style is not in our database, its shape is defined by its component type (e.g. Resistor or Diode), the shape (e.g. Rectangular or Circular) and the soldering features (e.g. SMD or non-SMD).
3. Transformer has shape defined by its core (e.g. EE, ETD or Toriod) and solder method (e.g. Vertical or Horizontal).
4. If the component is a heat sink, its shape is defined by the number of fins, the length of fins and the fin types (e.g. rectangular or triangular).
5. If the component is a PCB, its shape must be a board like and the thickness of PCB is set at the Edit component interface.
6. Otherwise, the component will be shaped as a simple block (e.g. Rectangle or Cylinder)

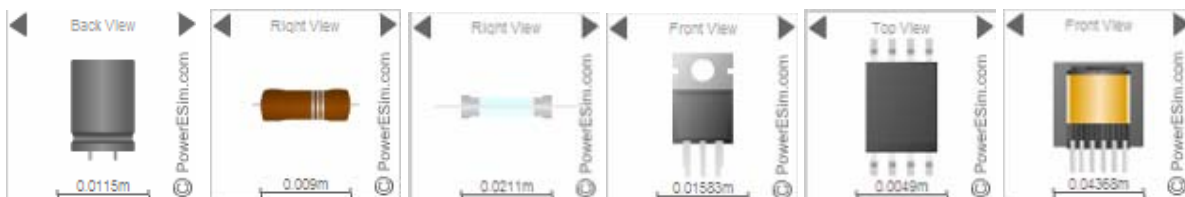
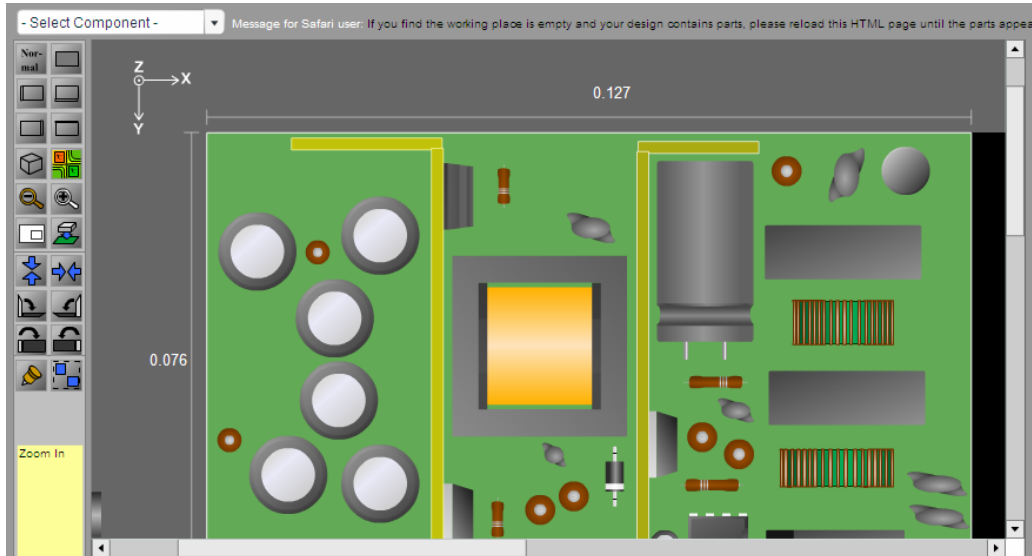


Figure: The shape of the components (Capacitor, Resistor, Fuse, TO220, IC and Transformer)

### 7.4.17 How to zoom in or zoom out the working area?



Figure: The buttons to zoom out (left) and zoom in (right)



Click the zoom in or zoom out button.

### 7.4.18 Select multiple components and move them together

Press and hold the SHIFT key, use mouse to select multiple components. Then, release the SHIFT key and drag on one of the selected component. The selected components can be moved together.

### 7.4.19 Group and ungroup components



Figure: The button to group components

After the multiple selection of component, click on group button. To ungroup, click on the grouped components and click on the group button again

### 7.4.20 Lock a component in position



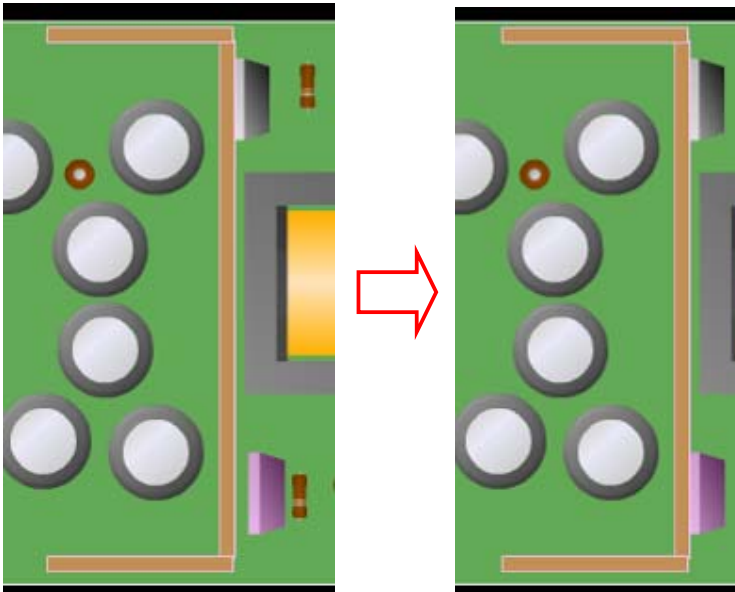
Figure: The button to lock components



Select a component or a group by clicking it and then click on the Lock button

### 7.4.21 Attach two components by the shortest distance



Figure: The button to attach components



Move 2 components within 100 pixel distance. Select them together by “SHIFT” key and then click . The component are attached together horizontally and grouped. This feature is very useful to attach power devices to heat sink. If you click , the components are attached vertically.

### 7.4.22 How to ungroup the attached components?



Figure: The buttons to split the attached components

Select the 2 attached components together by holding “Shift” button, and click on the Group/Ungroup button.

### 7.4.23 How to Rotate Components?



Figure: The buttons to rotate components



There are 4 ways to rotate the components.

1. Select a component or a group to rotate it clockwise at Top view.
2. Select a component or a group to rotate it anti-clockwise at Top view.
3. Select a component or a group to rotate it clockwise at Front view.
4. Select a component or a group to rotate it anti-clockwise at Front view.

### 7.4.24 Details of short-cut keys which help a lot

These are the short-cut keys provided by the interface:

1. K - Toggle lock to the selected component or group
2. SHIFT - Multiple selection
3. G - Group components together
4. N - Ungroup components
5. Left arrow - Move selected component left by one pixel
6. Right arrow - Move selected component right by one pixel
7. Up arrow - Move selected component up by one pixel
8. Down arrow - Move selected component down by one pixel
9. "+" - Zoom in
10. "-" - Zoom out

### 7.4.25 Put SMT component on the PCB



Figure: The button to the to put SMT component to PCB

You can attach the component on the PCB



## 7.5 MTBF Analysis - Life<sup>e</sup><sub>SIM</sub>

### 7.5.1 What is MTBF analysis?

MTBF analysis is a tool to let user to add components and its corresponding stress one by one, then pressing a button, the life time and MTBF of the system will be known immediately. User can treat it as a standalone tool to estimate the MTBF and life time of any product. If a power supply has initialized, all the components and its corresponding stress in the power supply will be seamlessly transfer to the tool for simulation.

### 7.5.2 Overall Failure Rate Result, MTBF and Life time

Simulated Overall Failure Rate	= 1.778 failures/10 <sup>6</sup> hours
Simulated Overall MTBF	= 562.6k hours
Simulated Overall Life Time	= 64k hours

The “Simulated Overall Failure Rate” means how many time the system will fail under 1 million hours, “Simulated Overall MTBF” means the average time between failure. The “Simulated Overall Life Time” means the life time of component having minimum life time. E-Cap and opto-coupler are considered to have life time issue.

### 7.5.3 Where is the individual failure rate

M1	540mΩ 600V 7.3A SPP07N60S5 INFINEON TO220		
	(1) $V_{sus} = 350.9\text{ V}$ (2) $I_{sus} = 1.983\text{ A}$ (3) $P_d = 1.39\text{ W}$ (4) $T_j = 60\text{ }^\circ\text{C}$	Failure Rate = 189.3m/(10 <sup>6</sup> Hrs)	Setting

Rather than showing overall failure rate, individual failure rate also been shown at the row of each component.

### 7.5.4 Electrical setting of each part can be modified

M1	540mΩ 600V 7.3A SPP07N60S5 INFINEON TO220		
	(1) $V_{sus} = 350.9\text{ V}$ (2) $I_{sus} = 1.983\text{ A}$ (3) $P_d = 1.39\text{ W}$ (4) $T_j = 60\text{ }^\circ\text{C}$	Failure Rate = 189.3m/(10 <sup>6</sup> Hrs)	1 Setting

1. Click the “Setting” button and then you can see the following table



**MTBF Analysis**  
General table for M1

Base Failure Factor: All Types

Junction Temp.: 60 °C  Use Customized Value

Application Factor: 50W~Power rating<250W

Quality Factor: Good-JANTX(100% test)

Environment Factor: Office environment-Ground, Benign

Done Close

2. Tick the checkbox or select the factor from the list
3. Press “Done” when finish

### 7.5.5 How to recalculate MTBF?

**MTBF Analysis**

Flyback AC/DC  $V_{o1} = 11.66 \text{ V}$

$V_{in} = 100$   $I_{o1} = 4 \text{ A}$

Recalculate  
Close  
Preferences

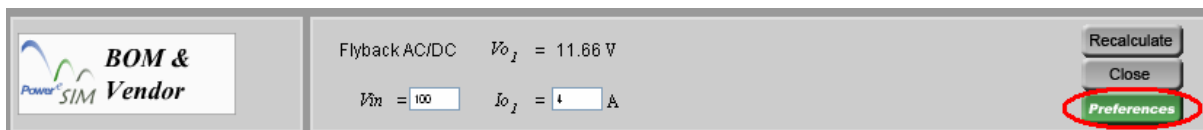
Press “Recalculate” after any change

## 7.6 BOM - BOM Builder

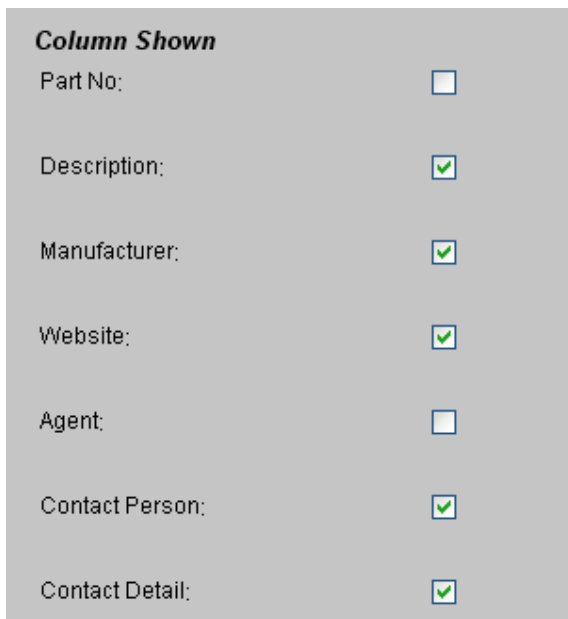
### 7.6.1 What is BOM Builder?

BOM Builder is a tool to let user to construct the Bill of Material BOM on their own. User can add component to BOM one by one or if a power supply has been initialized, all its component and corresponding details will be seamlessly transfer to BOM Builder. Every change on each component will be keep recorded. Revision of the overall BOM and each component will be generated automatically.

### 7.6.2 Customize column shown

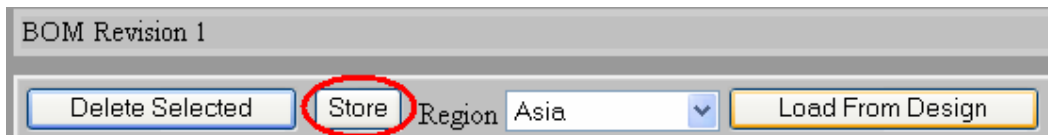


1. Press "Preference" and you can see the following



2. Tick any column you want to be shown in the BOM List

### 7.6.3 Update Current Revision



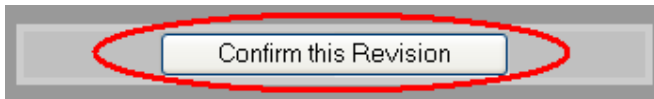
Press "Store" after any change

#### 7.6.4 Preview Revision



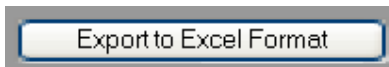
Press the button “Preview Revision XX”to preview the revision

#### 7.6.5 Confirm Revision



Press the button “Confirm this Revision” when you want to release this revision

#### 7.6.6 Export to Excel format



Press the button “Export to Excel format” to export the BOM to EXCEL format

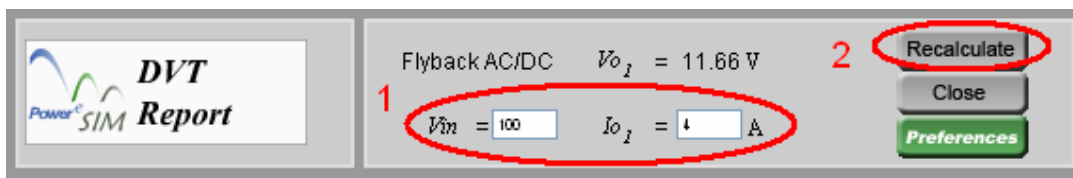
## 7.7 DVT Reports - DVT<sup>e</sup><sub>SIM</sub>

### 7.7.1 What is DVT report?

Design Verification Test DVT report may be second important tool as it report all the component stress under user defined situation. Reject, warning or pass will be commended on each component to ensure the design quality.

Reject means a fatal design error and had to be corrected. Warning means a cut corner design, no instantaneously fail will happen. Pass means the component is working safe.

### 7.7.2 Change the current condition



1. Input the new value
2. Press “Recalculate”

### 7.7.3 4 Corners Test

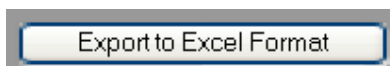


1. Press the button and the following will be shown after few second

Ref	Description		Simulated Value	Rated Value	Rated Factor	Result	Message	Condition
C7	22nF 250V 10x8.5x3mm MKS4 WIMA 20%	Vsus	238.1V	250V	950m	Reject	You may need to select a capacitor having higher sustain voltage rating.	Vin=100V, Io1=4A (To Current Condition Test)

2. Click on one of the link to view the component’s detail under the condition

### 7.7.4 Export to Excel format



Press the button “Export to Excel format” to export the DVT report to EXCEL format

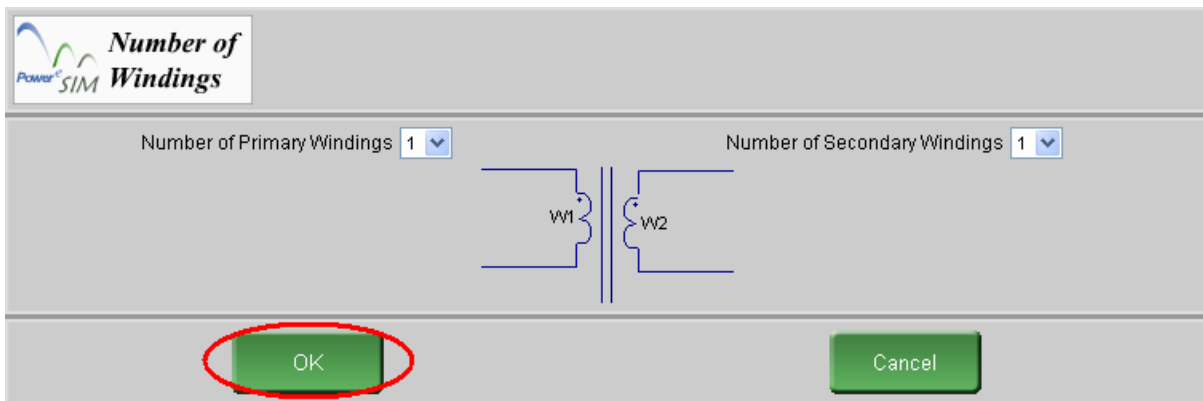
## 7.8 Magnetic Builder

### 7.8.1 What is magnetic builder?

Magnetic Builder is a tool for user to create his/her own magnetic component by selecting different ferrite core, bobbin type and winding method. Engineering drawing will be automatically produced to reduce user work load.

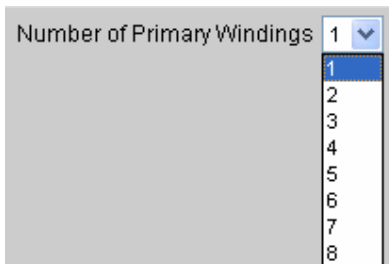
All the transformer build can be saved and reused onto a power supply, as long as the winding number are matched.

### 7.8.2 Create a new transformer



Click “Magnetic Builder” a “Number of Windings” page appear for user to first defining the number of primary winding and number of secondary winding.

### 7.8.3 Add number of primary and secondary winding

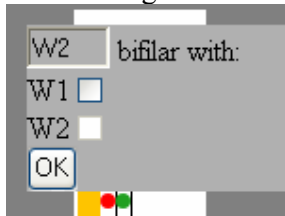


The number of primary winding and number of secondary winding can be change. The default value is one.

### 7.8.4 Add Bifilar



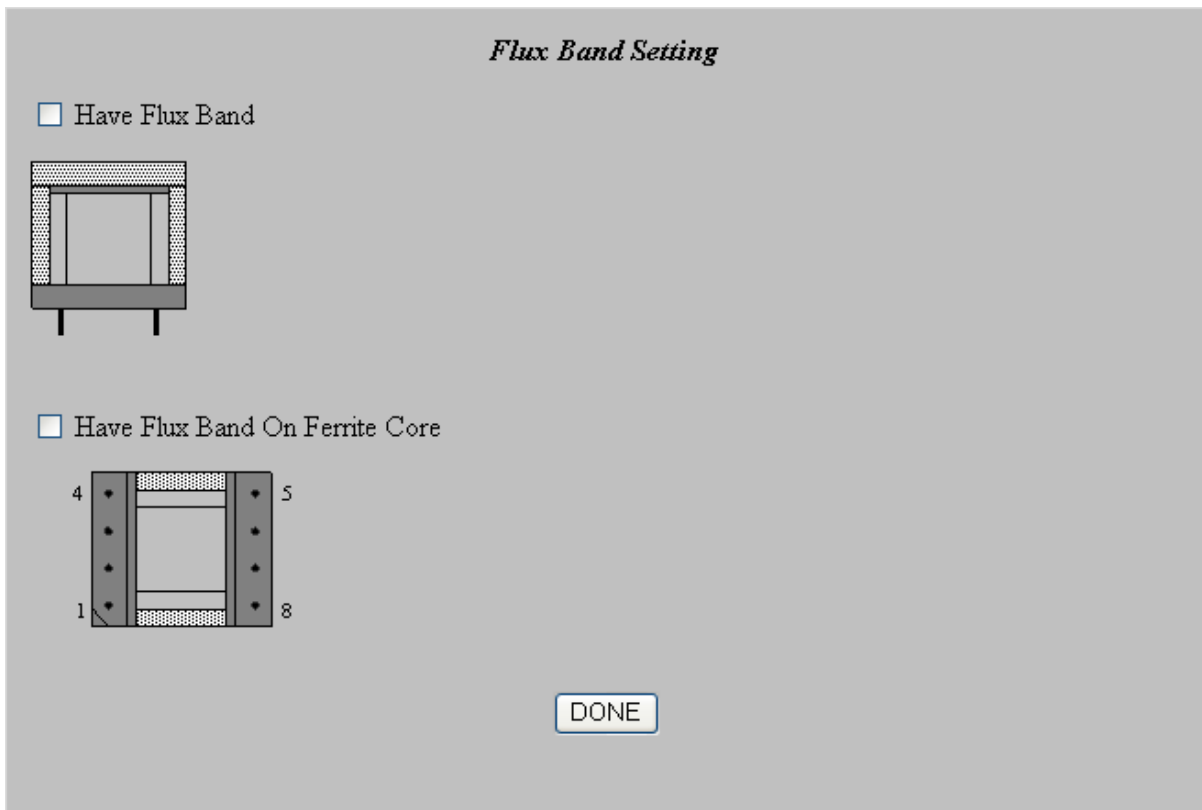
1. Move cursor to the winding
2. The winding will turn RED
3. Click on the winding and you can see the picture as below
4. Winding with the same number of turn will be shown and can be selected for bilfilar.



### 7.8.5 Flux Band



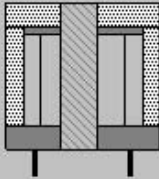
Click the button "Flux Band"



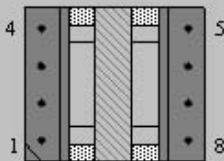
Two type of flux band are supported. Click the checkbox to add the flux band.



### Flux Band Setting

 Have Flux Band

 Flux Band Thickness:  mm

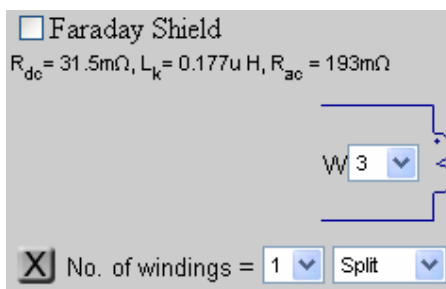
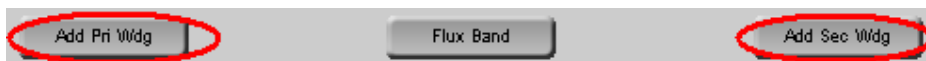
 Flux Band Width:  mm

 Have Flux Band On Ferrite Core

 Flux Band On Ferrite Thickness:  mm

 Flux Band On Ferrite Width:  mm

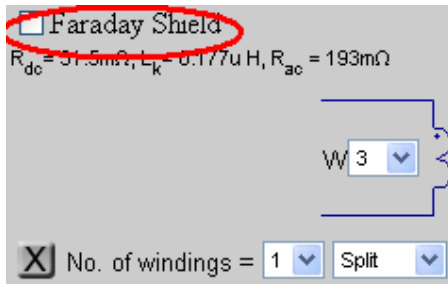
After clicked the checkbox, the core with the flux band can be preview. The Flux band thickness and width can be set.

### 7.8.6 Add Primary / Secondary Winding



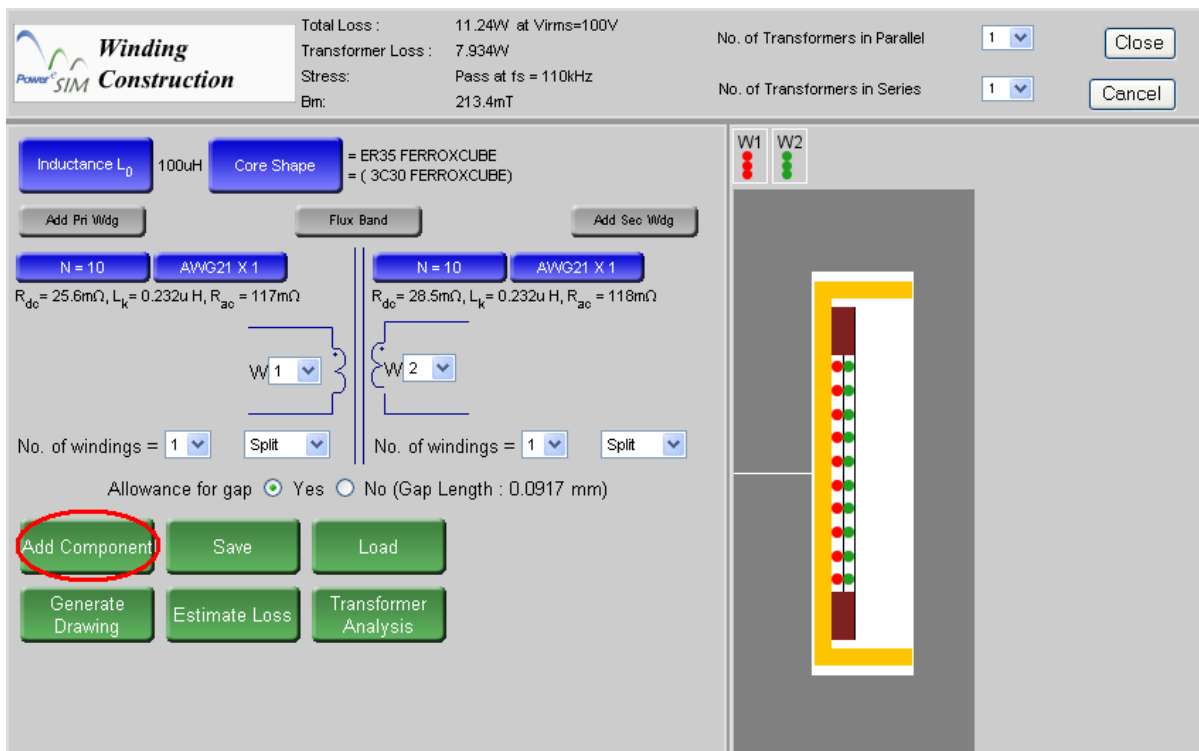
Extra Winding can be added by clicking “Add Pri Wdg” or “Add Sec Wdg.” The usage of this feature is recommended for non-operating winding only. User is recommended to preset the proper winding number at the “Number of Windings” page.

### 7.8.7 Faraday Shield

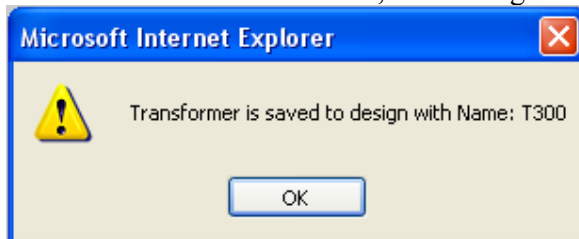


The user can change a particular winding to Faraday Shield. Only extra windings can be changed to Faraday Shield.

### 7.8.8 Add a transformer to the design

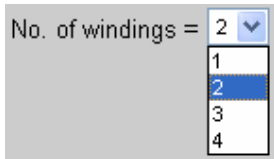
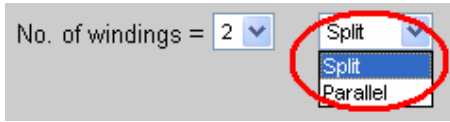


After creating a new transformer, you can add it to the design by pressing “Add Component”. When the transformer is added, the message with transformer's designator is shown.



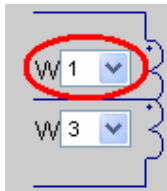


### 7.8.9 Make split winding or parallel winding



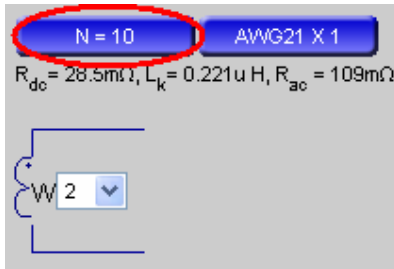
User can “Split” a winding to several section by choosing from “No. of windings” or Parallel Winding in any winding for sandwiching winding method.

### 7.8.10 Customize the winding order



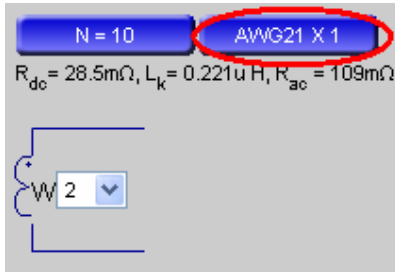
The winding order can be changed by the list box. W1 means the most inner layer.

### 7.8.11 Adjust number of turns for each winding



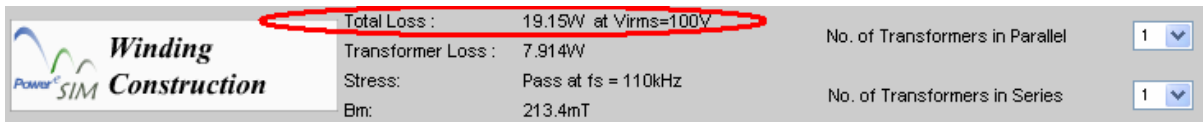
The number of turns for each winding is shown in the blue button. You can press this button to modify the number of turns.

**7.8.12 Select the wire used for each winding**



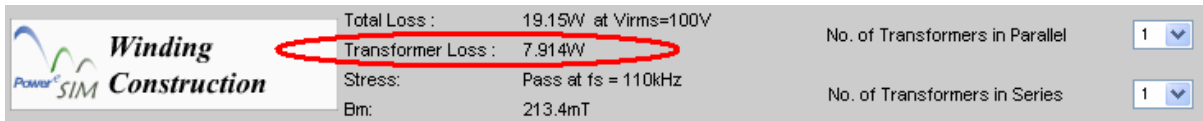
The wire information for each winding is shown in the blue button. It shows the Wire name and the number of parallel wires. You can press this button to modify it.

**7.8.13 Every change can affect the total loss**



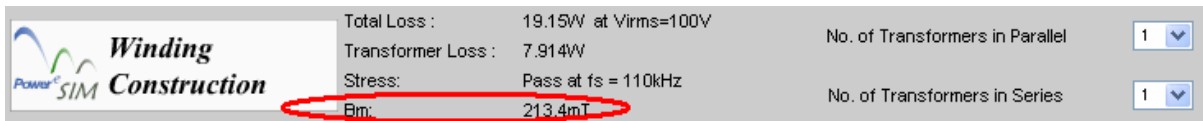
The “Total Loss” means the overall losses of the power supply and is shown at the top of the interface and will be automatically updated for any changed in transformer design.

**7.8.14 Every change can affect transformer loss**



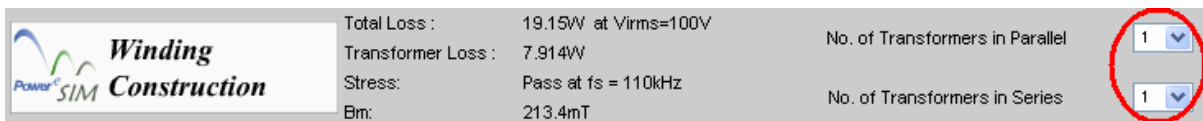
The “Transformer Loss” means the losses of the whole transformer and is shown at the top of the interface and will be automatically updated for any changed in transformer design.

**7.8.15 Some change can affect the Peak Flux**



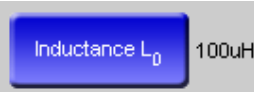
The “Bm” means the peak flux density of the transformer and is shown at the top of the interface and will be automatically updated for any changed in transformer design.

**7.8.16 Putting transformers in parallel / series**



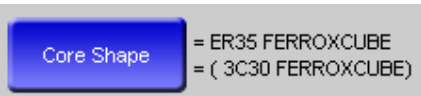
You can clone the current transformer and produce a set of transformer and place them in parallel or in series.

### 7.8.17 Changing the transformer inductance



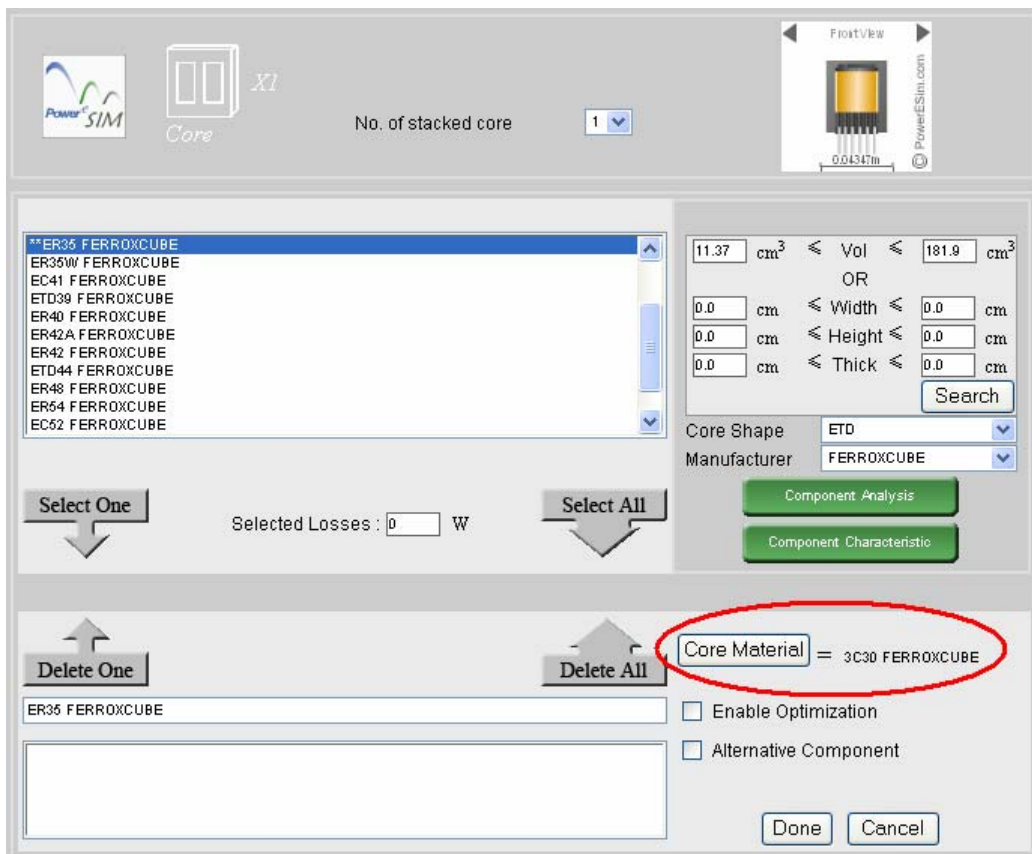
Inductance value is shown in the interface. On the left there is a blue button which can be used to modify the inductance.

### 7.8.18 Select different core shape and manufacturer



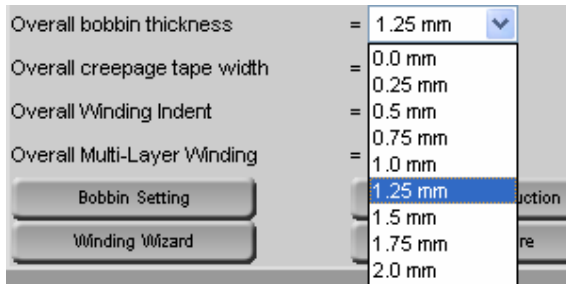
Information on the selected core and selected magnetic materials is shown. You can press the blue button to change it.

### 7.8.19 Select different core material



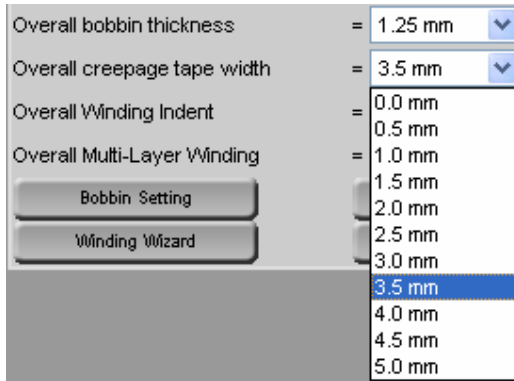
After you press on “Core Shape”, you can see the following page.  
 You can click on “Core Material” button on the bottom right to select different core material.

### 7.8.20 Overall bobbin thickness can be adjusted



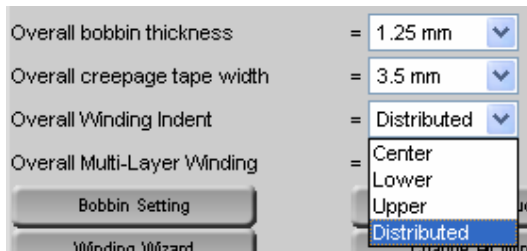
Overall bobbin thickness is a short cut to change all the left, upper and lower bobbin thickness at once.

### 7.8.21 Adjust the overall creepage tape width



Overall creepage tape width is a short cut to change all the upper and lower creepage tape widths in all winding.

### 7.8.22 Adjust the Overall winding indent



Overall Winding Indent is a short cut to change all the winding indents in all winding.

### 7.8.23 Adjust the Overall Multi-Layer Winding setting

Overall bobbin thickness	=	1.25 mm	▼
Overall creepage tape width	=	3.5 mm	▼
Overall Winding Indent	=	Distributed	▼
Overall Multi-Layer Winding	=	Shared	▼
		Tight	
		Shared	

Bobbin Setting

Overall Multi-Layer Winding is a short cut to change all the Multi-Layer Winding property.

### 7.8.24 Change the No. of wire in parallel

Power SIM X1 Wire

No. of Wire in Parallel = 1

Use Copper Foil

0.414 mm ≤ Dia ≤ 1.656 mm

Search

Wire Type Magnet Wire

Manufacturer any

Component Analysis

Component Characteristic

Select One Selected Losses : 0 W Select All

Delete One Delete All

0.828mm 180deg ISOBOND TripleCoated AWG21 Magnet Wire SHELHAV

Enable Optimization

Alternative Component

Done Cancel

After you select the wire (section 7.8.12), you can see the above page.

### 7.8.25 Adjust the overall wire used in all winding

Bobbin Setting Windings Construction

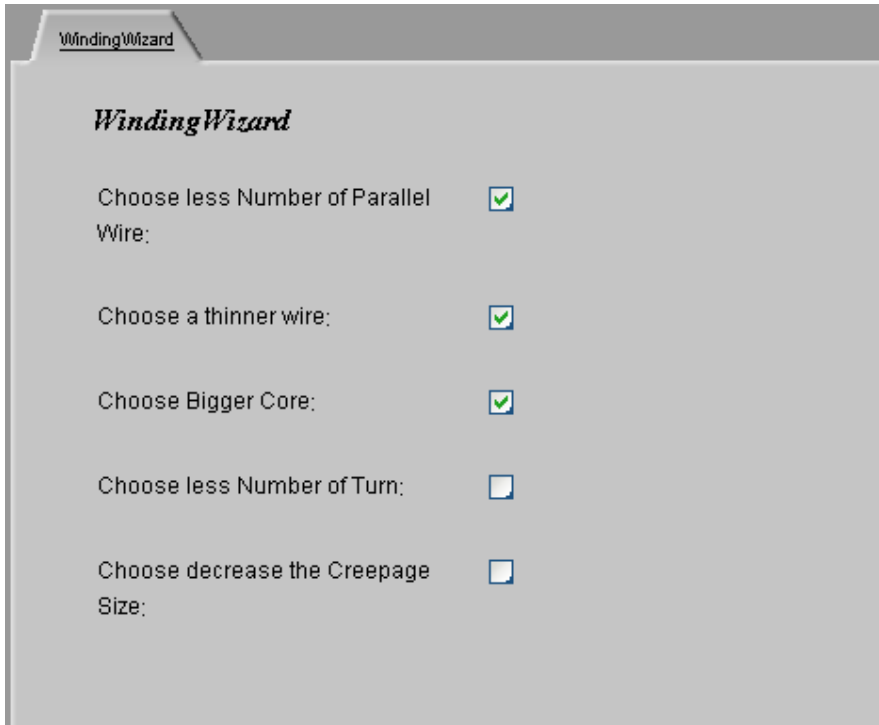
Winding Wizard Change All Wire

There is a shortcut button “Change All wire” that can change the wire for all winding by one step only.

### 7.8.26 How to change the Winding Wizard option?



After you press the button “Winding Wizard”, you can see the following page and set the winding wizard option.

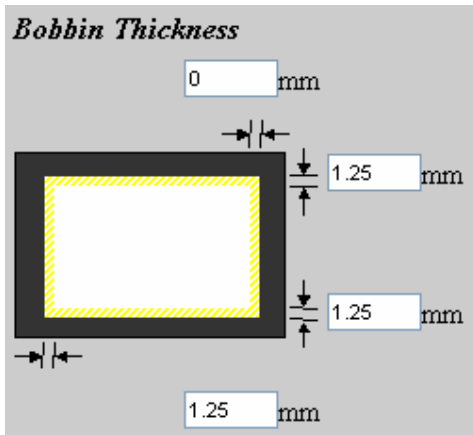


The check box in the “Winding Wizard” page provide a list of allowable background actions when the wire winding area is bigger than the allowable winding window area.

### 7.8.27 Change bobbin thickness on each side



After press the button “Bobbin Setting”, then you can see

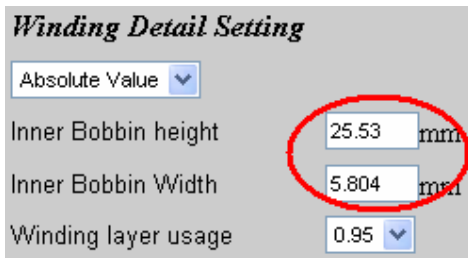


All four side of the bobbin can be individually adjusted.

### 7.8.28 Configure the bobbin winding window dimension



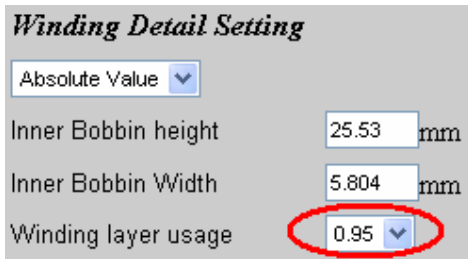
After press the button “Bobbin Setting”, then you can see



### 7.8.29 How to change the winding layer usage?



After press the button “Bobbin Setting”, then you can see

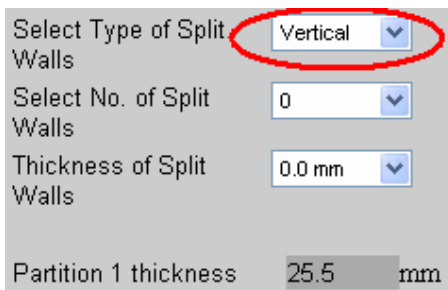


The winding layer usage is the usage ratio between the allowable bobbin height and Inner Bobbin height.

### 7.8.30 Bobbin with split walls



After press the button “Bobbin Setting”, then you can see



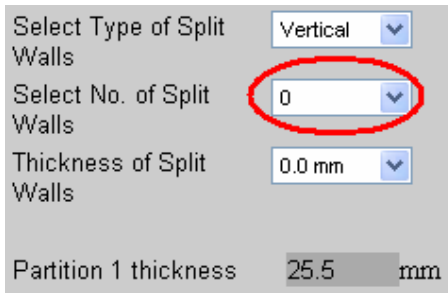
User can choose Vertical or Horizontal type of split wall.



### 7.8.31 Configure number of split walls



After press the button “Bobbin Setting”, then you can see

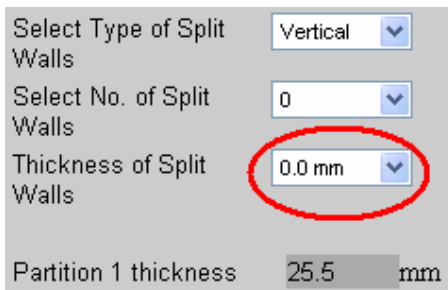


User can design number of split walls by choosing from “Select No. of Split Walls”

### 7.8.32 Configure the thickness of split walls



After press the button “Bobbin Setting”, then you can see



User can design the thickness of the split wall by choosing from “Thickness of Split Walls”

### 7.8.33 Configure the thickness of each partition

If you set more than 1 split walls in section 7.8.31, you can see

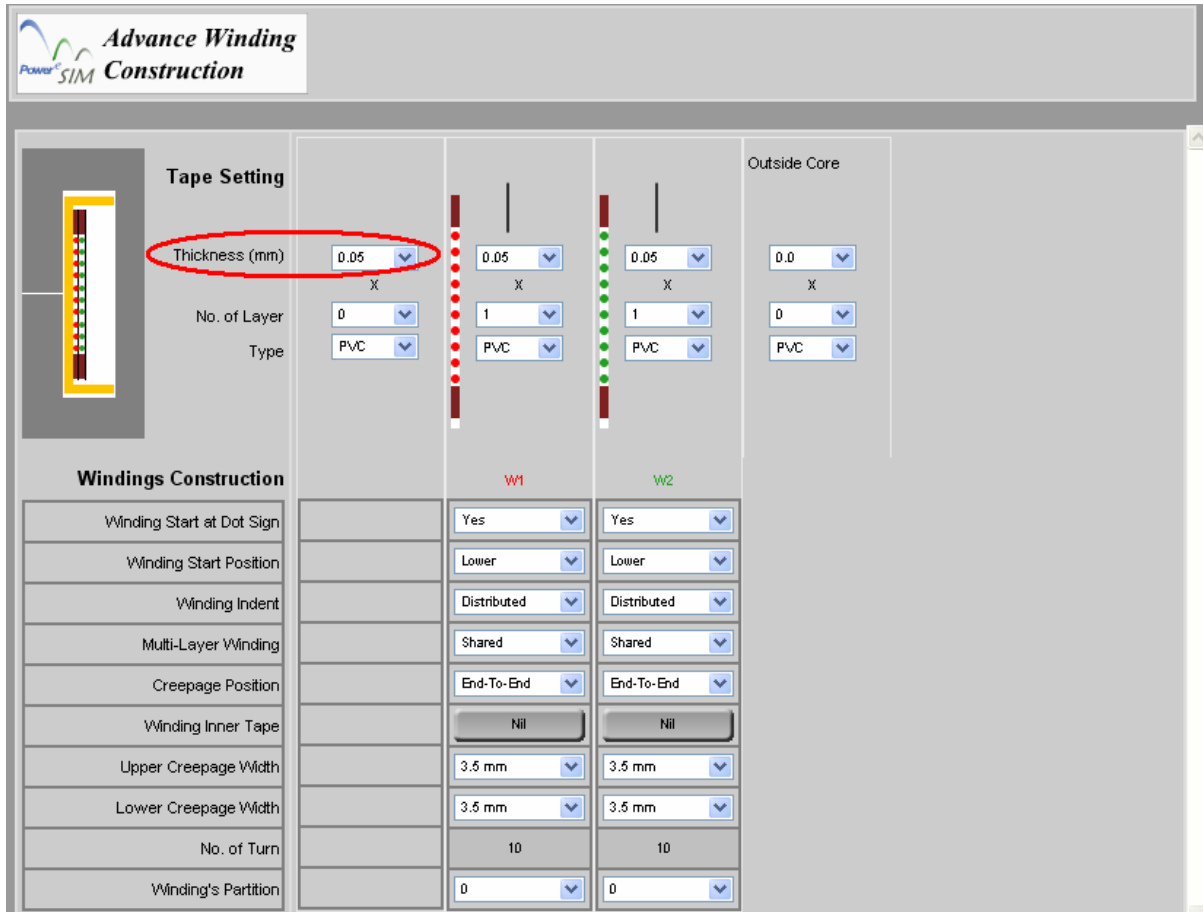
User can design the individual window height of each partition by clicking the arrows to increase or decrease partition thickness.

### 7.8.34 Configure tape characteristic in each winding

After pressing the button “Winding Construction”, user will see the “Advance Winding Construction” page

Basically each copper winding has its inherent tape winding for insulation. If no insulation is need set No. of layer to 0.

### 7.8.34.1 Configure the tape thickness of each winding



**Advance Winding Construction**

**Tape Setting**

Thickness (mm) **0.05** X

No. of Layer 0 X

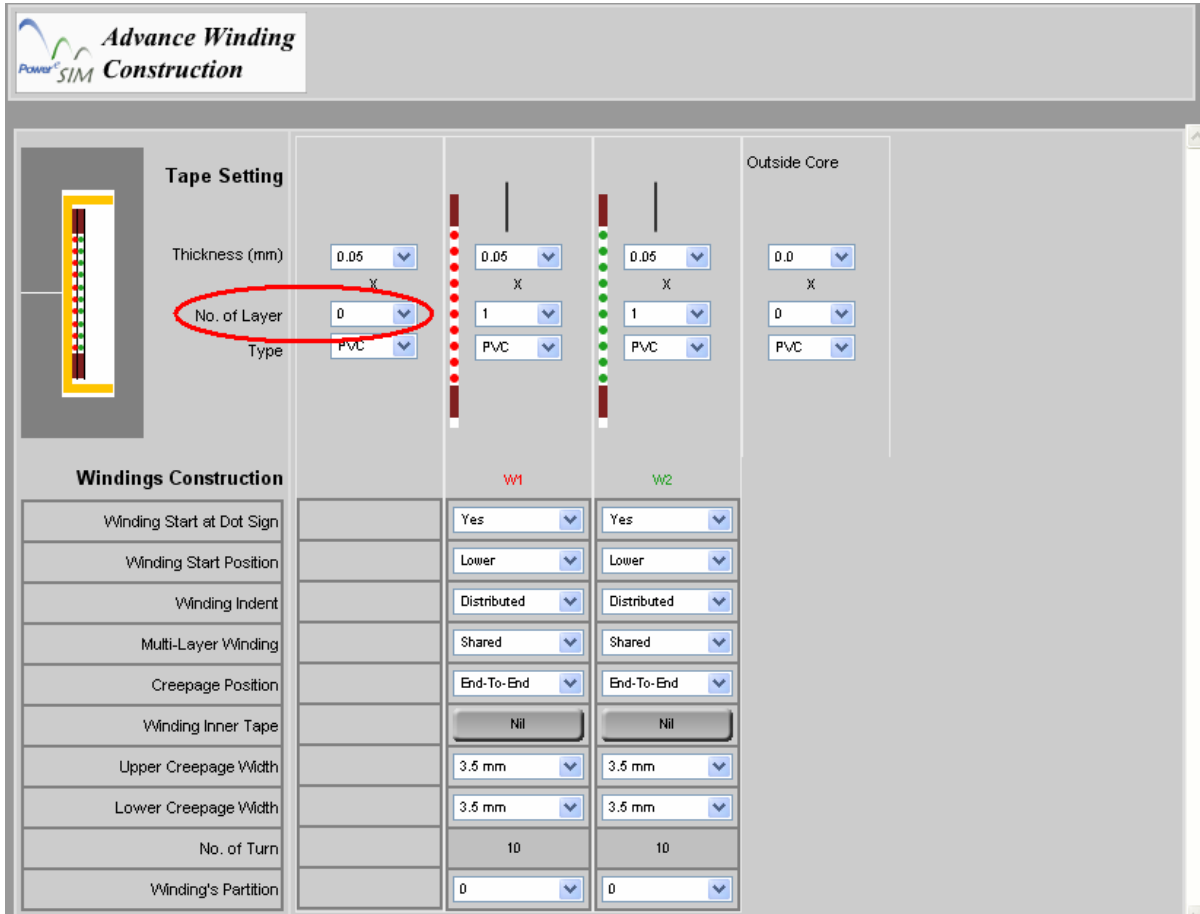
Type PVC X

**Winding Construction**

	W1	W2
Winding Start at Dot Sign	Yes	Yes
Winding Start Position	Lower	Lower
Winding Indent	Distributed	Distributed
Multi-Layer Winding	Shared	Shared
Creepage Position	End-To-End	End-To-End
Winding Inner Tape	Nil	Nil
Upper Creepage Width	3.5 mm	3.5 mm
Lower Creepage Width	3.5 mm	3.5 mm
No. of Turn	10	10
Winding's Partition	0	0

The thickness of tape can be set by changing the value of “Thickness (mm)”

7.8.34.2 Configure the number of layer in each winding



**Advance Winding Construction**

**Tape Setting**

Thickness (mm) 0.05 X

**No. of Layer** 0 X

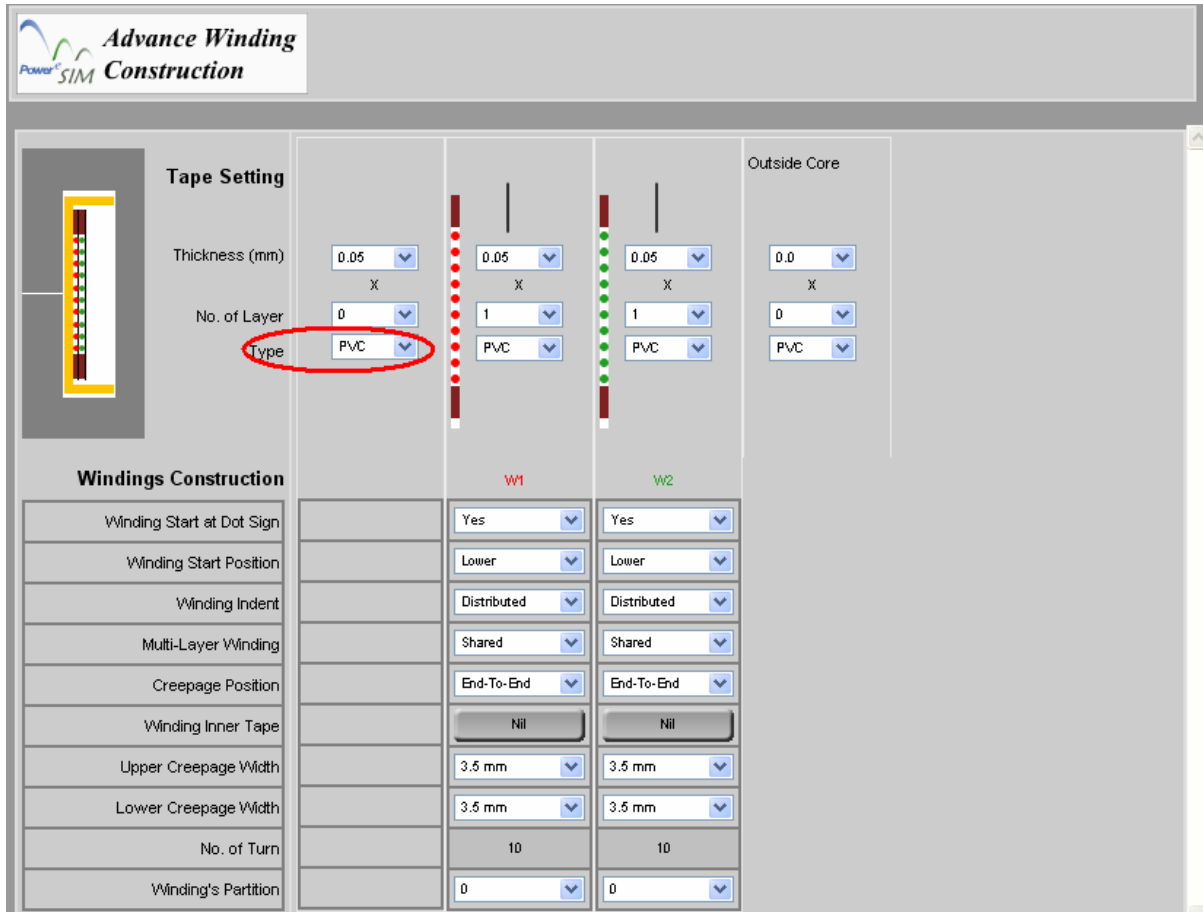
Type PVC

**Windings Construction**

	W1	W2
Winding Start at Dot Sign	Yes	Yes
Winding Start Position	Lower	Lower
Winding Indent	Distributed	Distributed
Multi-Layer Winding	Shared	Shared
Creepage Position	End-To-End	End-To-End
Winding Inner Tape	Nil	Nil
Upper Creepage Width	3.5 mm	3.5 mm
Lower Creepage Width	3.5 mm	3.5 mm
No. of Turn	10	10
Winding's Partition	0	0

The no of turn of the tape can be set by changing the value of “No. of Layer”

### 7.8.35 Configure the tape type used in each winding



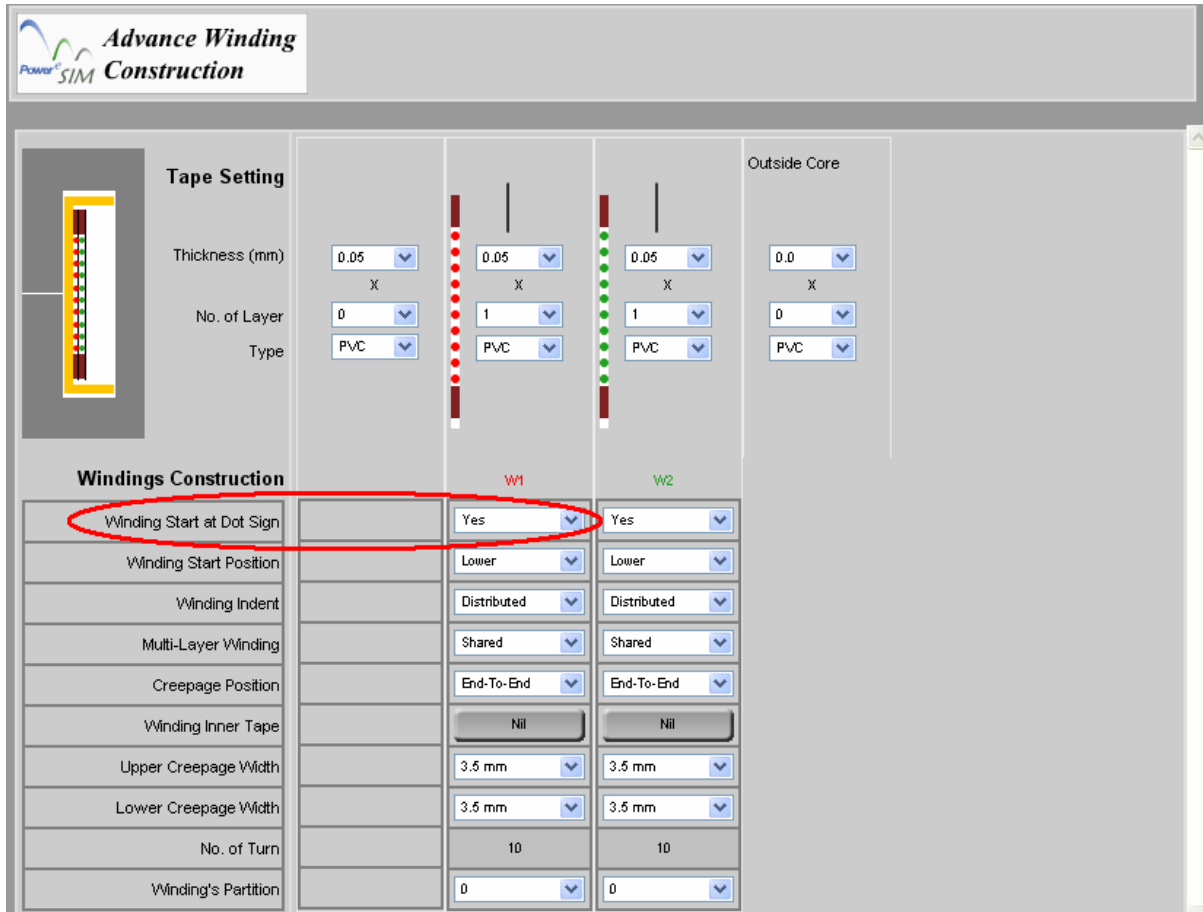
Tape Setting		W1	W2	Outside Core
Thickness (mm)	0.05	0.05	0.05	0.0
No. of Layer	0	1	1	0
Type	PVC	PVC	PVC	PVC

Winding Construction		W1	W2
Winding Start at Dot Sign		Yes	Yes
Winding Start Position		Lower	Lower
Winding Indent		Distributed	Distributed
Multi-Layer Winding		Shared	Shared
Creepage Position		End-To-End	End-To-End
Winding Inner Tape		Nil	Nil
Upper Creepage Width		3.5 mm	3.5 mm
Lower Creepage Width		3.5 mm	3.5 mm
No. of Turn		10	10
Winding's Partition		0	0

The material of the tape can also be set by “Type”

### 7.8.36 Configure the dot sign of each winding



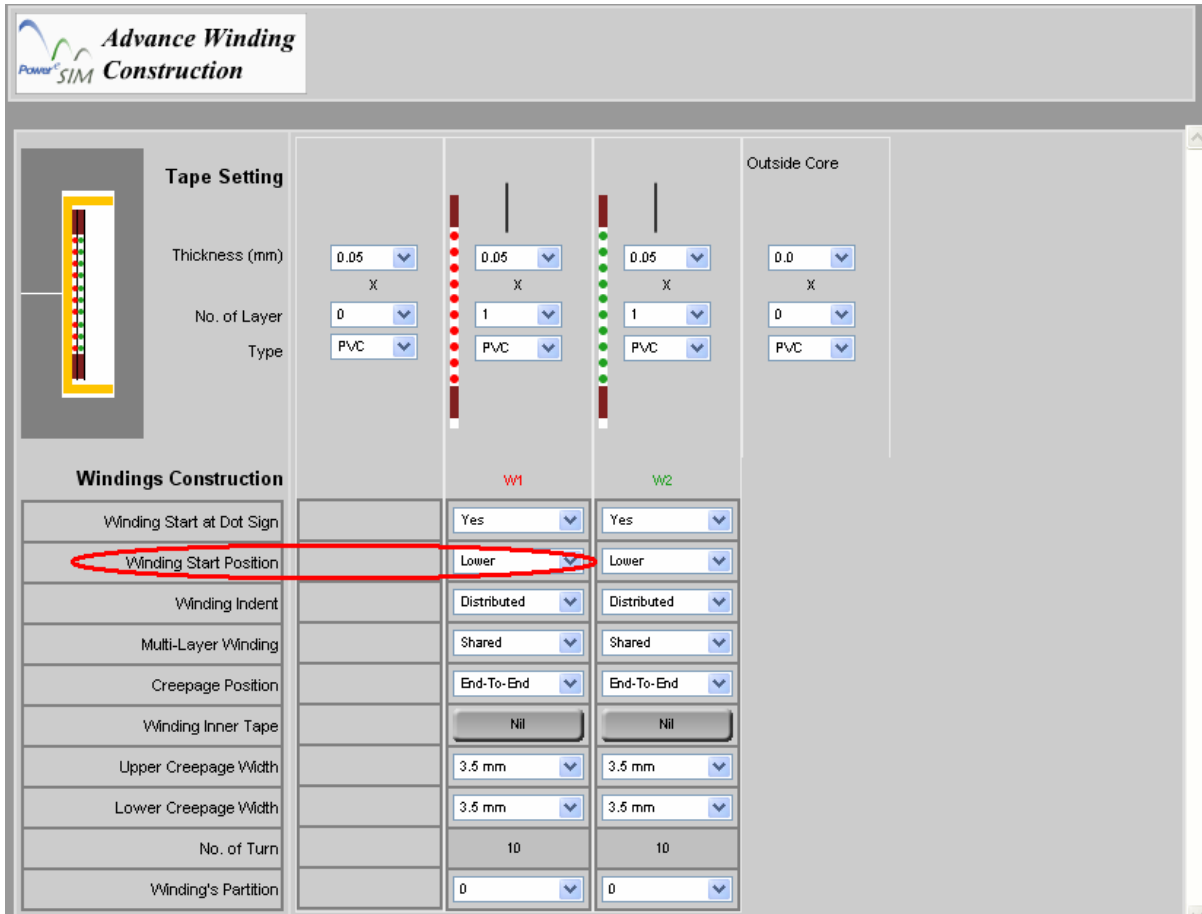
Tape Setting		W1	W2	Outside Core
Thickness (mm)	0.05	0.05	0.05	0.0
No. of Layer	0	1	1	0
Type	PVC	PVC	PVC	PVC

Windings Construction		W1	W2
Winding Start at Dot Sign		Yes	Yes
Winding Start Position		Lower	Lower
Winding Indent		Distributed	Distributed
Multi-Layer Winding		Shared	Shared
Creepage Position		End-To-End	End-To-End
Winding Inner Tape		Nil	Nil
Upper Creepage Width		3.5 mm	3.5 mm
Lower Creepage Width		3.5 mm	3.5 mm
No. of Turn		10	10
Winding's Partition		0	0

User can choose whether the dot sign is lie with winding started at the “Winding Start at Dot Sign” box.

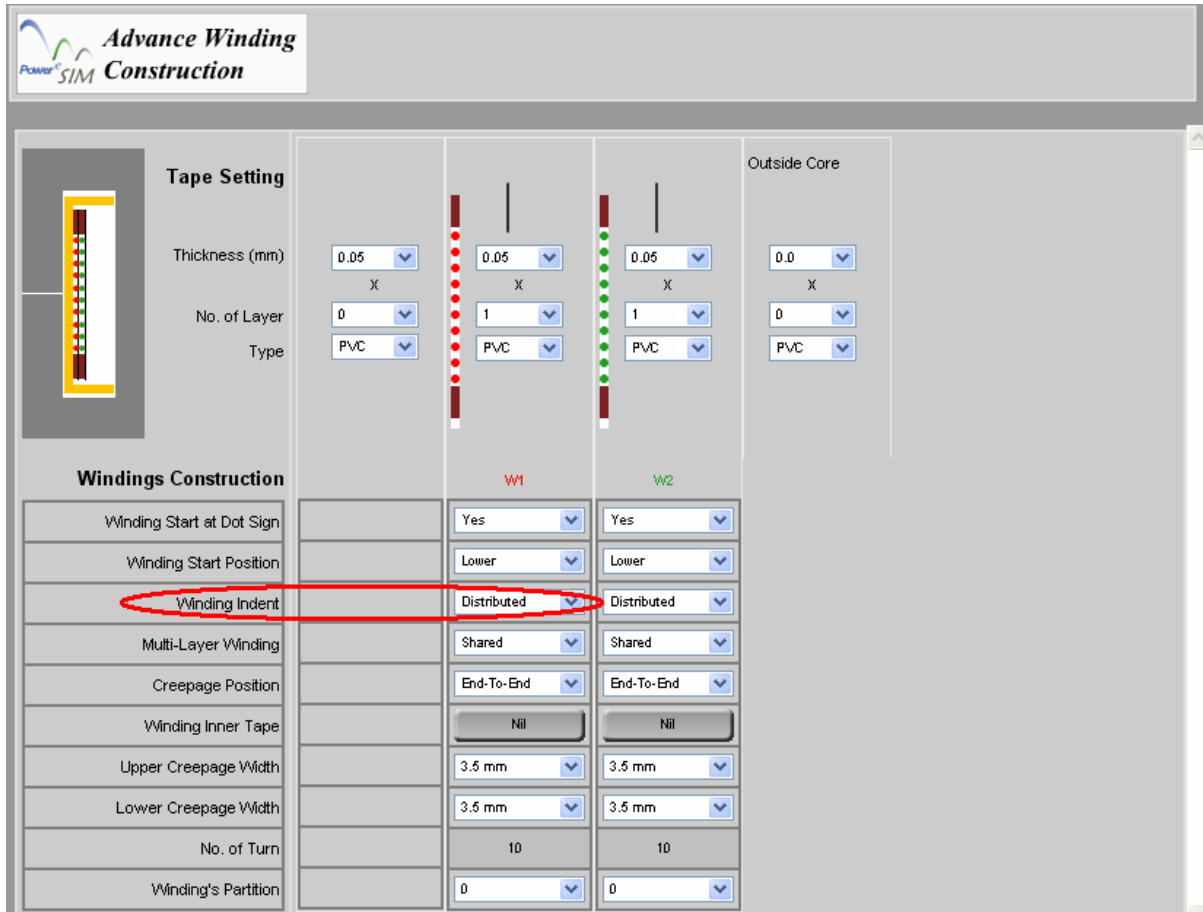
### 7.8.37 Define the winding start position of each winding



	W1	W2	Outside Core
<b>Tape Setting</b>			
Thickness (mm)	0.05	0.05	0.05
No. of Layer	1	1	0
Type	PVC	PVC	PVC
<b>Winding Construction</b>			
Winding Start at Dot Sign	Yes	Yes	
Winding Start Position	Lower	Lower	
Winding Indent	Distributed	Distributed	
Multi-Layer Winding	Shared	Shared	
Creepage Position	End-To-End	End-To-End	
Winding Inner Tape	Nil	Nil	
Upper Creepage Width	3.5 mm	3.5 mm	
Lower Creepage Width	3.5 mm	3.5 mm	
No. of Turn	10	10	
Winding's Partition	0	0	

User can choose the winding start position at the “Winding Start Position” box.

### 7.8.38 Configure the winding indent of each winding



**Advance Winding Construction**

**Tape Setting**

	W1	W2	Outside Core
Thickness (mm)	0.05	0.05	0.05
No. of Layer	1	1	0
Type	PVC	PVC	PVC

**Windings Construction**

	W1	W2
Winding Start at Dot Sign	Yes	Yes
Winding Start Position	Lower	Lower
Winding Indent	Distributed	Distributed
Multi-Layer Winding	Shared	Shared
Creepage Position	End-To-End	End-To-End
Winding Inner Tape	Nil	Nil
Upper Creepage Width	3.5 mm	3.5 mm
Lower Creepage Width	3.5 mm	3.5 mm
No. of Turn	10	10
Winding's Partition	0	0

User can choose how the wire is packed at the “Winding Indent” box.

Distributed – wire will evenly wind in the allowable winding height.

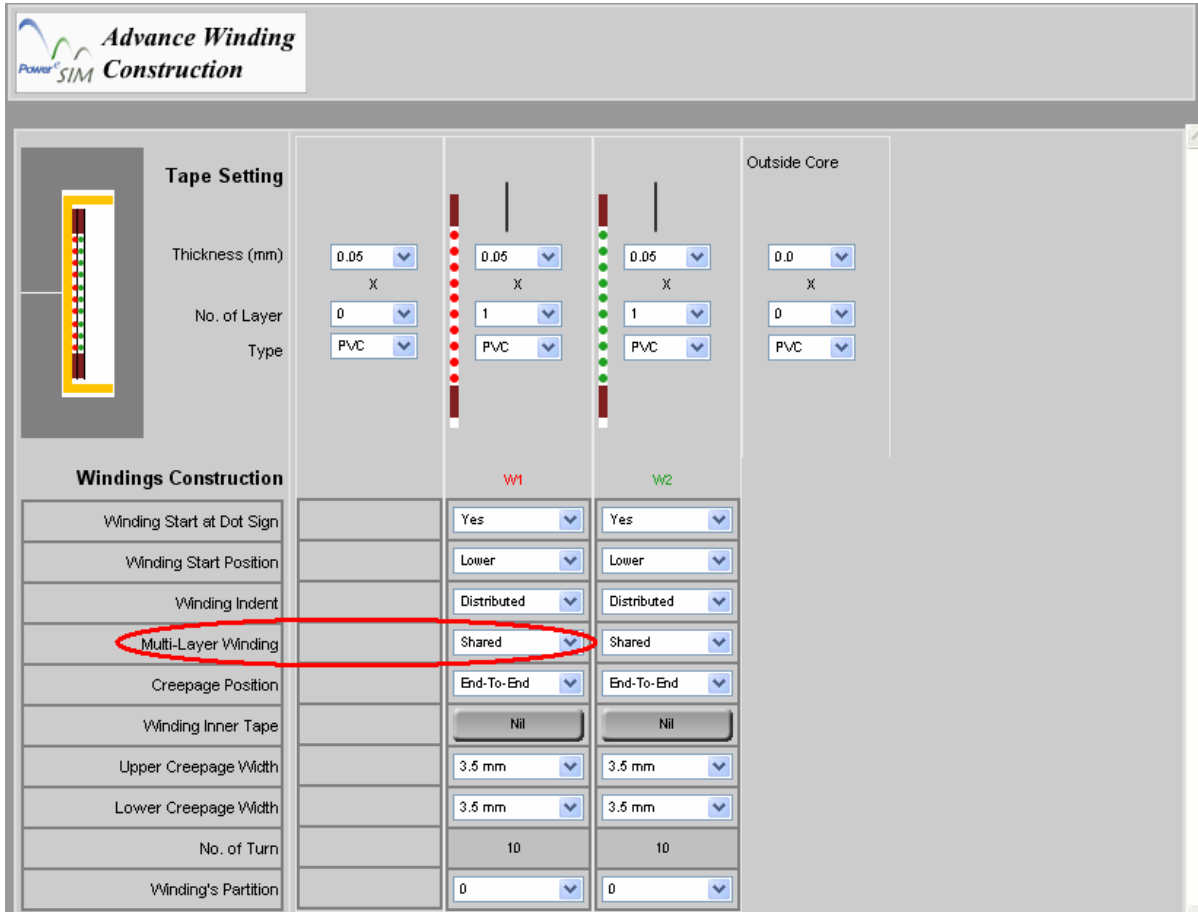
Center – wire will be packed tight at center of the allowable winding height.

Low – wire will be packed tight at lower part of the allowable winding height.

Upper – wire will be packed tight at the upper part of the allowable winding height.



### 7.8.39 Configure the characteristic of multi-layer winding of each winding



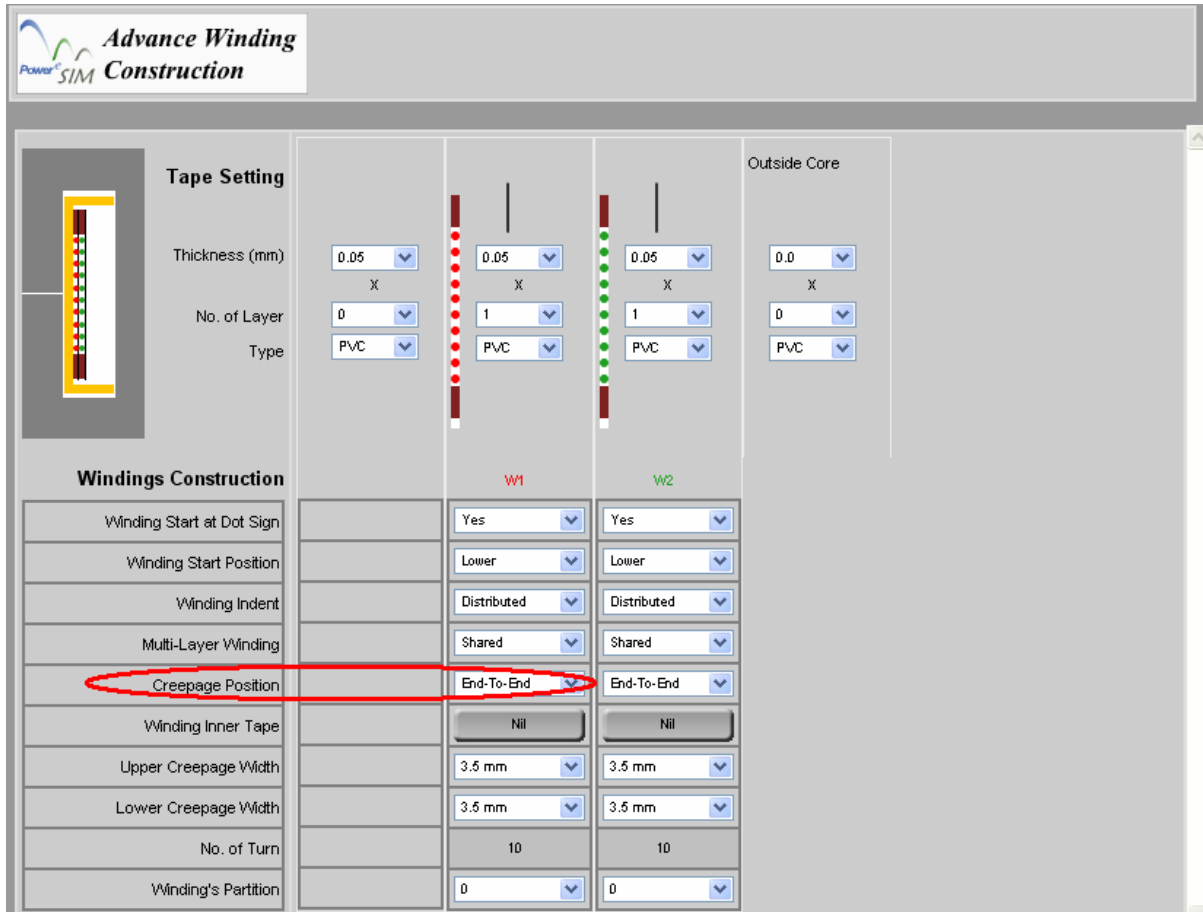
	W1	W2	Outside Core
<b>Tape Setting</b>			
Thickness (mm)	0.05	0.05	0.05
No. of Layer	1	1	0
Type	PVC	PVC	PVC
<b>Windings Construction</b>			
Winding Start at Dot Sign	Yes	Yes	
Winding Start Position	Lower	Lower	
Winding Indent	Distributed	Distributed	
Multi-Layer Winding	Shared	Shared	
Creepage Position	End-To-End	End-To-End	
Winding Inner Tape	Nil	Nil	
Upper Creepage Width	3.5 mm	3.5 mm	
Lower Creepage Width	3.5 mm	3.5 mm	
No. of Turn	10	10	
Winding's Partition	0	0	

User can choose how the wire is arranged if more than 1 layer is needed to complete the winding in the “Multi-Layer Winding” box

Shared – wire will evenly shared in each layer

Tight – wire will be just tightly wind.

### 7.8.40 Creepage position



**Advance Winding Construction**

**Tape Setting**

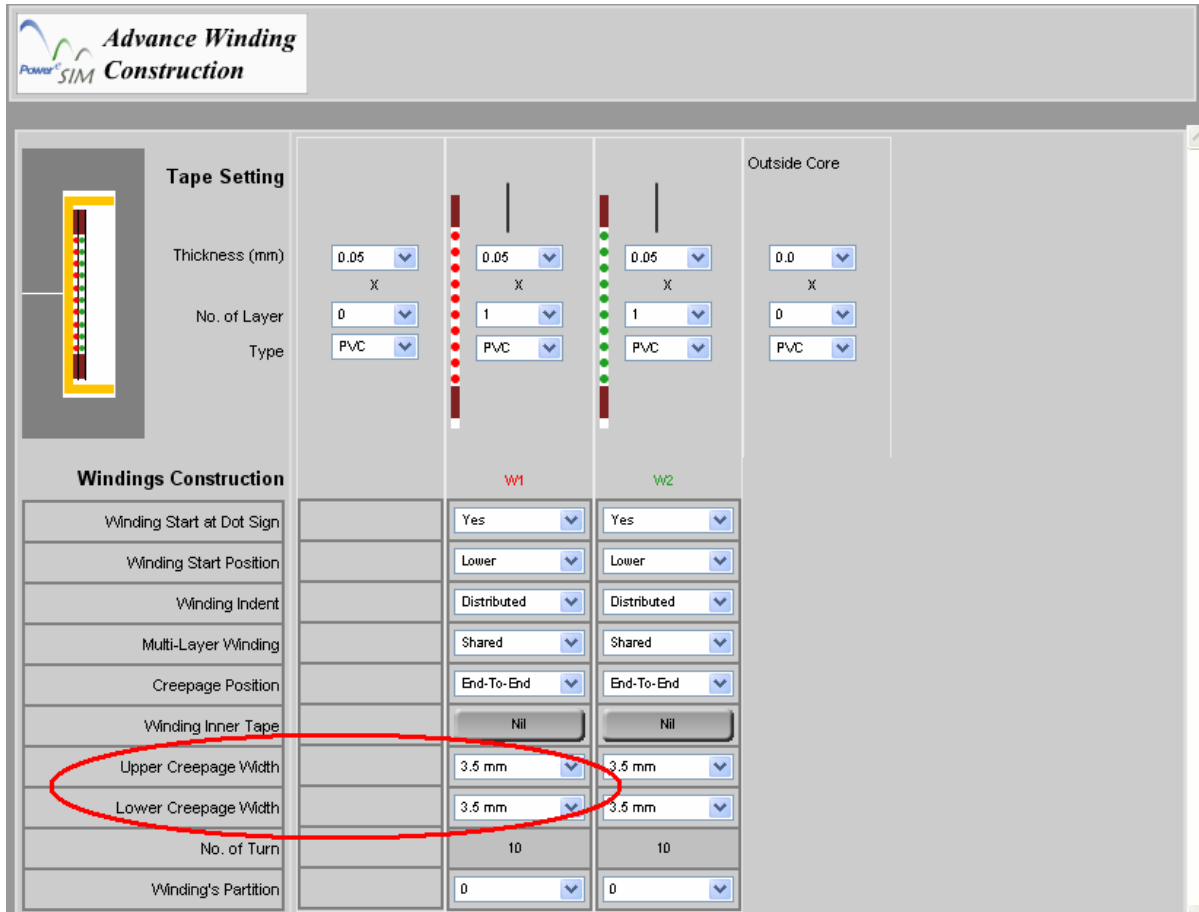
	W1	W2	Outside Core
Thickness (mm)	0.05	0.05	0.05
No. of Layer	1	1	0
Type	PVC	PVC	PVC

**Windings Construction**

Winding Start at Dot Sign	Yes	Yes
Winding Start Position	Lower	Lower
Winding Indent	Distributed	Distributed
Multi-Layer Winding	Shared	Shared
<b>Creepage Position</b>	<b>End-To-End</b>	End-To-End
Winding Inner Tape	Nil	Nil
Upper Creepage Width	3.5 mm	3.5 mm
Lower Creepage Width	3.5 mm	3.5 mm
No. of Turn	10	10
Winding's Partition	0	0

User can choose how the creepage tape is placed in the “Creepage Position” box  
 End-To-End – Creepage tape will placed at both end of the allowable winding height  
 Tight – Creepage tape will placed just beside the wire.

### 7.8.41 Creepage width of each winding



**Advance Winding Construction**

**Tape Setting**

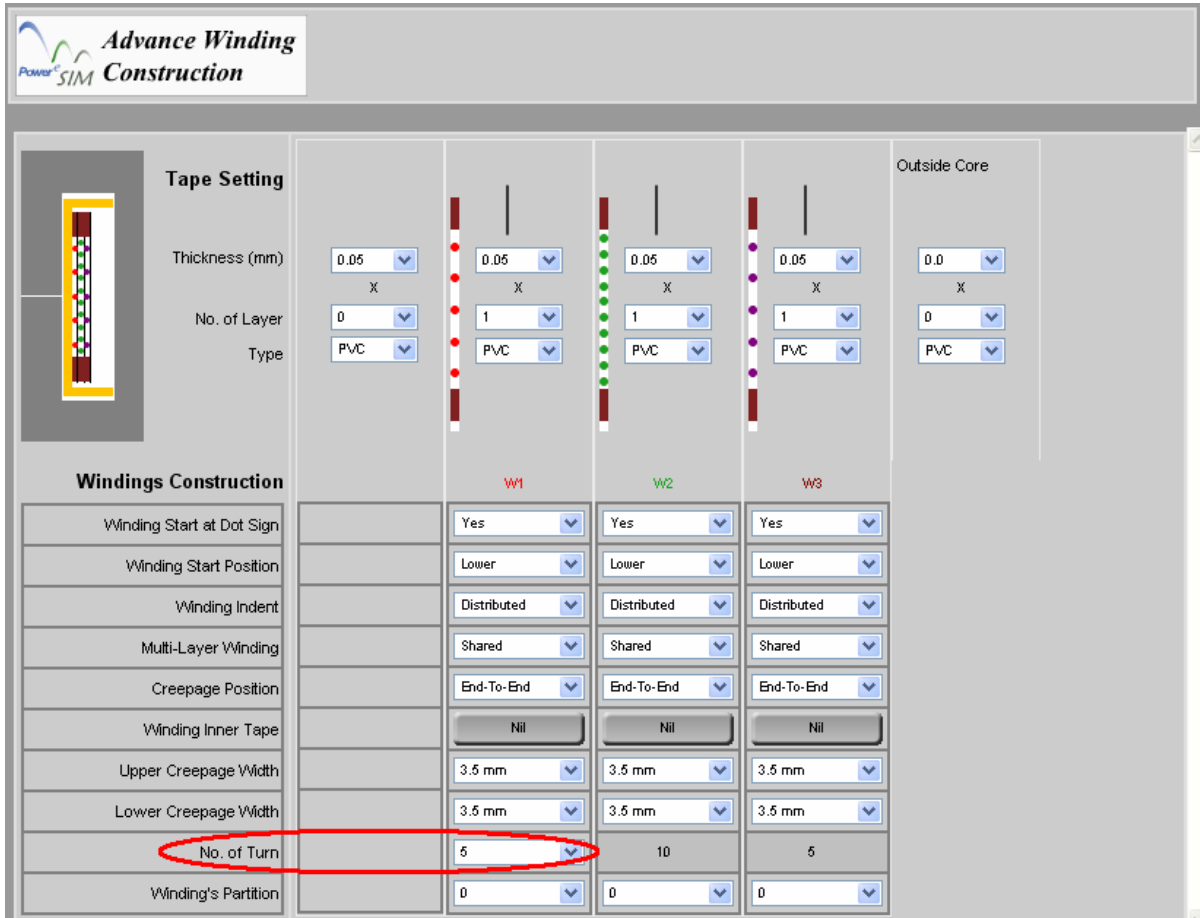
Parameter	W1	W2	Outside Core
Thickness (mm)	0.05	0.05	0.05
No. of Layer	1	1	0
Type	PVC	PVC	PVC

**Windings Construction**

Parameter	W1	W2
Winding Start at Dot Sign	Yes	Yes
Winding Start Position	Lower	Lower
Winding Indent	Distributed	Distributed
Multi-Layer Winding	Shared	Shared
Creepage Position	End-To-End	End-To-End
Winding Inner Tape	Nil	Nil
Upper Creepage Width	3.5 mm	3.5 mm
Lower Creepage Width	3.5 mm	3.5 mm
No. of Turn	10	10
Winding's Partition	0	0

User can choose how the width of the creepage tapes by changing “Upper Creepage Width” or “Lower Creepage Width” box.

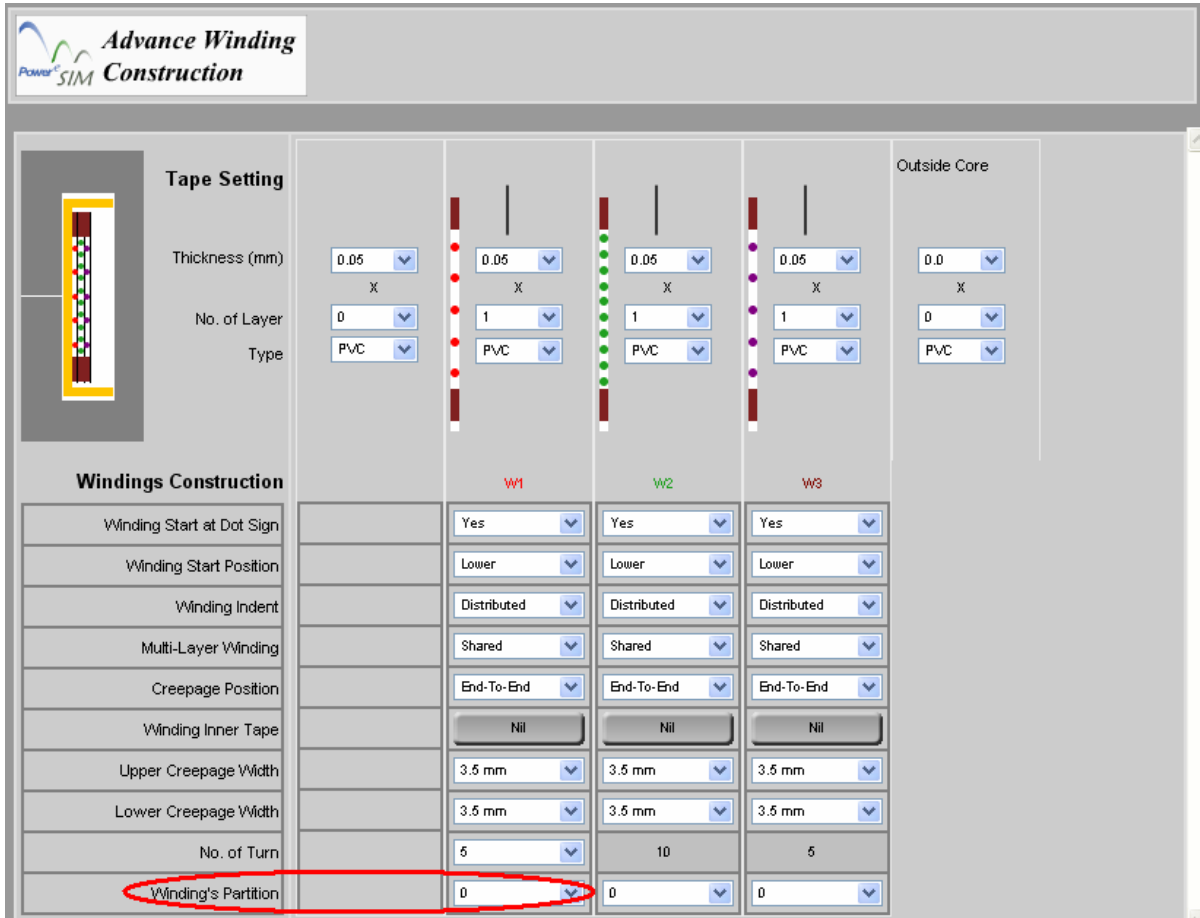
### 7.8.42 Change the number of turns of each split winding



	W1	W2	W3	Outside Core
<b>Tape Setting</b>				
Thickness (mm)	0.05	0.05	0.05	0.05
No. of Layer	1	1	1	0
Type	PVC	PVC	PVC	PVC
<b>Windings Construction</b>				
Winding Start at Dot Sign	Yes	Yes	Yes	
Winding Start Position	Lower	Lower	Lower	
Winding Indent	Distributed	Distributed	Distributed	
Multi-Layer Winding	Shared	Shared	Shared	
Creepage Position	End-To-End	End-To-End	End-To-End	
Winding Inner Tape	Nil	Nil	Nil	
Upper Creepage Width	3.5 mm	3.5 mm	3.5 mm	
Lower Creepage Width	3.5 mm	3.5 mm	3.5 mm	
No. of Turn	5	10	5	
Winding's Partition	0	0	0	

If more than 1 split sub-winding are made (section 7.8.9), you can change the number of turns of the each split winding by changing “No. of Turn” box.

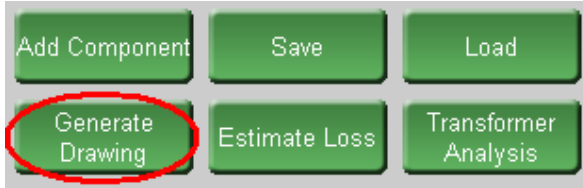
**7.8.43 Locate the winding in which bobbin partition**



	W1	W2	W3	Outside Core
<b>Tape Setting</b>				
Thickness (mm)	0.05	0.05	0.05	0.05
X	X	X	X	X
No. of Layer	1	1	1	0
Type	PVC	PVC	PVC	PVC
<b>Windings Construction</b>				
Winding Start at Dot Sign	Yes	Yes	Yes	
Winding Start Position	Lower	Lower	Lower	
Winding Indent	Distributed	Distributed	Distributed	
Multi-Layer Winding	Shared	Shared	Shared	
Creepage Position	End-To-End	End-To-End	End-To-End	
Winding Inner Tape	Nil	Nil	Nil	
Upper Creepage Width	3.5 mm	3.5 mm	3.5 mm	
Lower Creepage Width	3.5 mm	3.5 mm	3.5 mm	
No. of Turn	5	10	5	
Winding's Partition	0	0	0	

If more than one partition (section 7.8.31 & 7.8.32), user can locate the winding in any partition by changing “Winding’s Partition” box.

### 7.8.44 Generate Transformer Drawing



*(English Only)*

X' former Description: Default Transformer X'former P/N: Rev. A

Magnetic Core Used: ER35 3C30 FERROXCUBE

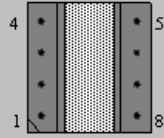
Bobbin Type: Vertical 8 pin bobbin

Bobbin P/N:

Bobbin Manufacturer:

Select Bobbin

Add Fly Pins



After pressing “Generate Drawing”, user can fill in all the detail information for making a professional transformer drawing.

#### 7.8.44.1 Designed parameters of a transformer

**Designed Parameters**

Measured @ 100k Hz Press  for Production test

Description	Pin 1 - Pin 2	Pin 3 - Pin 4
DC Resistance	<input checked="" type="checkbox"/> 25.6mΩ <31mOhm	<input type="checkbox"/> 28.5mΩ
Magnetizing Inductance	<input checked="" type="checkbox"/> 100uH =100uH +/- 5%	<input type="checkbox"/> 100uH
Leakage Inductance	<input checked="" type="checkbox"/> 0.232uH <0.28uH	<input type="checkbox"/> 0.232uH

User can fill in checking parameter, e.g. DC resistance, Magnetizing Inductance and Leakage Inductance, for IQC. Once the check box is clicked, the value between the corresponding pins is enabled for inspection. Simulated value is recommended but user can change the actual IQC specification by change wording in the corresponding text box.

#### 7.8.44.2 Change the testing details of Transformer Drawing

**Testing Details** *(English Only)*

Hi-pot P - S Voltage: 4000V AC

Hi-pot P- core Voltage: 4000V AC

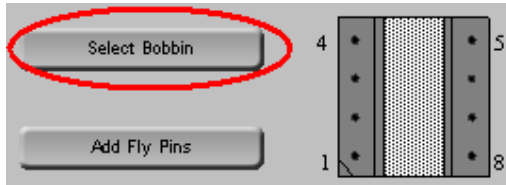
Hi-pot S- core Voltage: 4000V AC

Hi-pot Period: 1 Sec

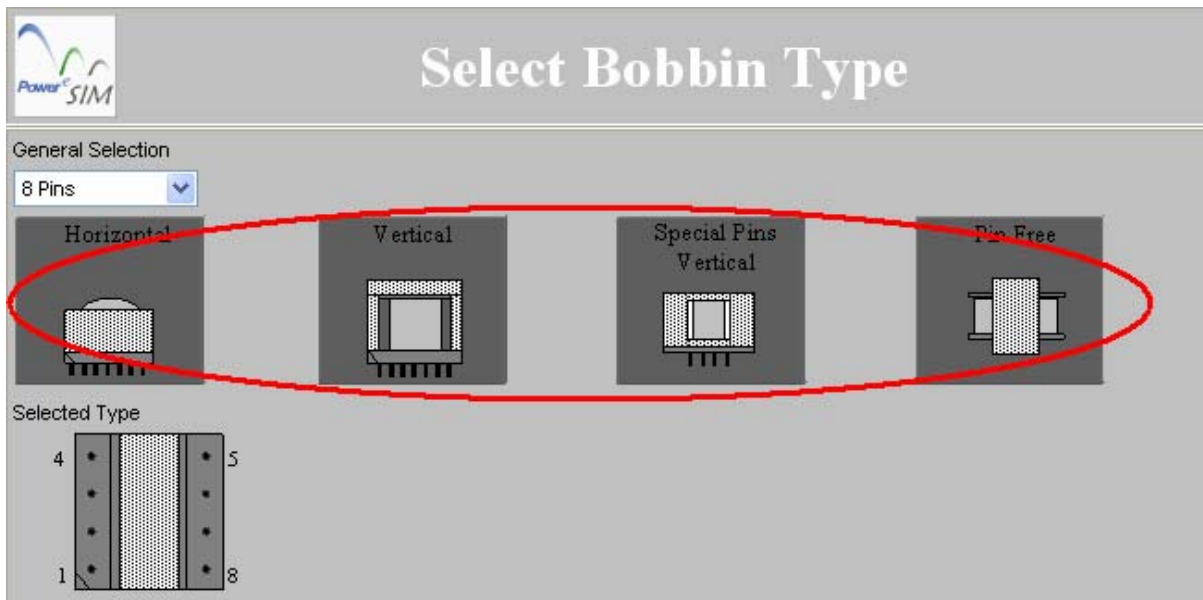
Remark:

User can fill in the testing details in the bottom of Transformer Drawing interface.

### 7.8.44.3 Different type of bobbin can be selected

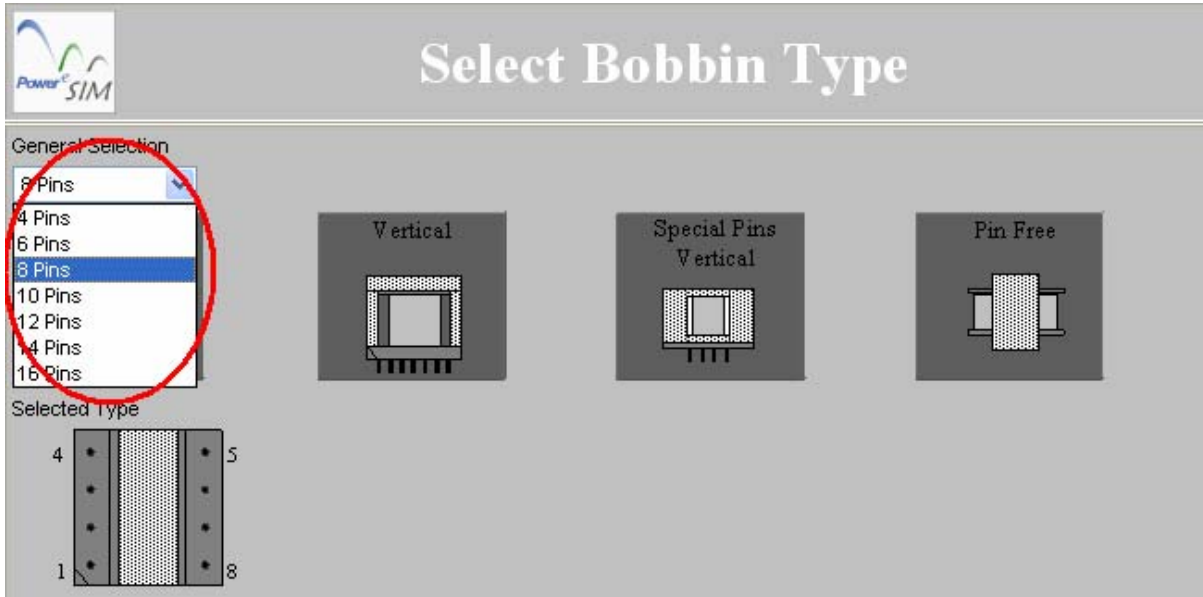


User press "Select Bobbin" at the top-right side and will see the following page.



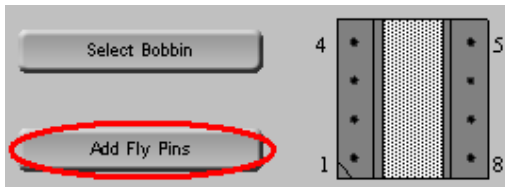
Click on the picture to select bobbin type

7.8.44.4 Change the number of pins of bobbin

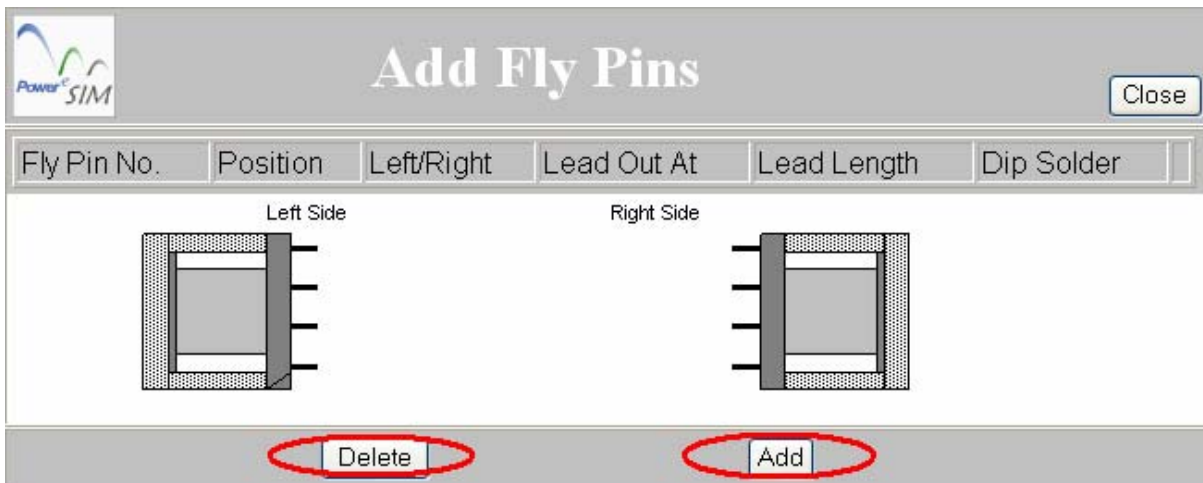


User can change the number of pins of bobbin there.

7.8.44.5 Add/ delete fly pins



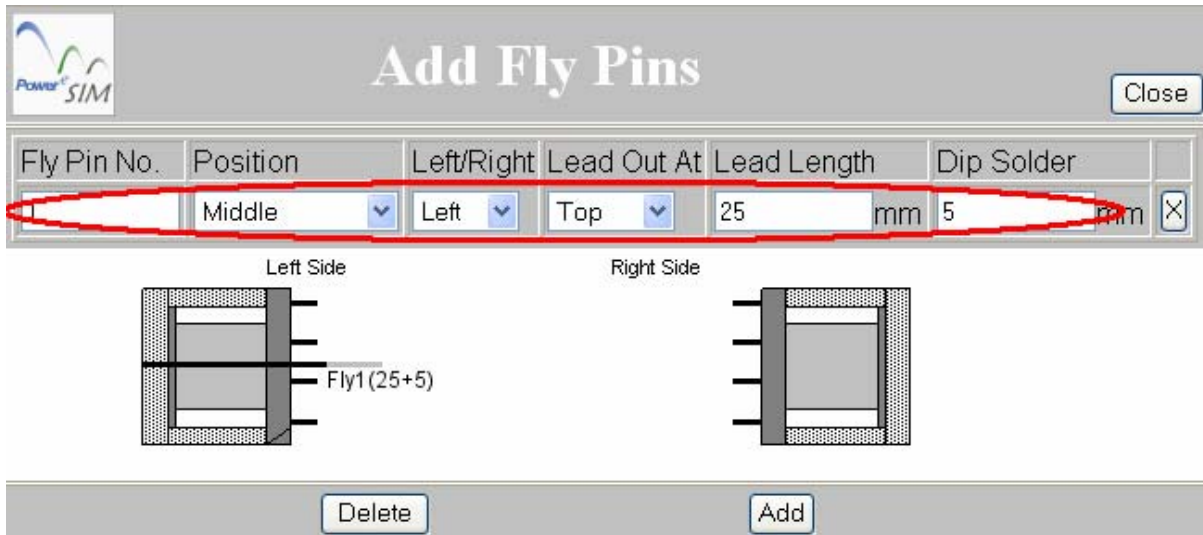
In “Generate Drawing” page (section 7.8.44), user press “Add Fly Pins” at the top-right side and user can see the following page.



User can add or delete fly pins pressing corresponding button

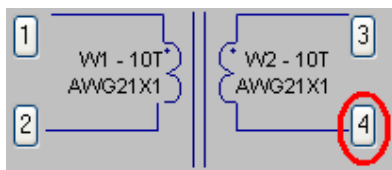


### 7.8.44.6 Configure details of fly pins

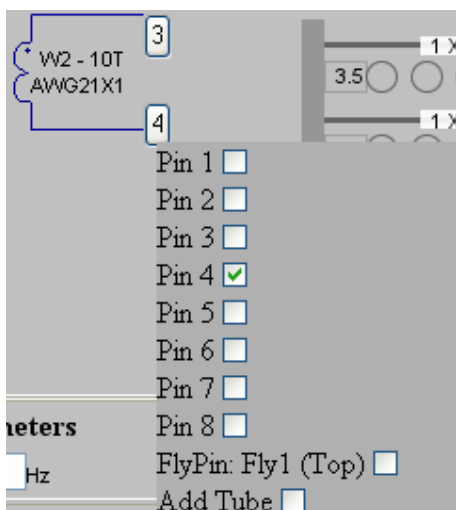


After adding fly pins (section 7.8.44.5), you can modify the detail of the fly pin or delete the corresponding fly pin by pressing “X”.

### 7.8.44.7 Define the termination pins of a winding



Press the number button can open an interface that can define the termination of a winding.



User can click one or more of the pins or fly pins available.

7.8.44.8 Preview the Transformer drawing page

The 'Preview' button at the bottom can open a preview page of the transformer drawing.

Magnetizing Inductance @ 100k Hz Winding Start & Positive Rotation  
 $L_m(5-4) = 830\mu H \pm 5\%$

DC Resistance  
 $R_{dc}(5-4) < 2.50\Omega$

Leakage Inductance @ 100k Hz  
 $L_k(5-4) < 7.9\mu H$

Core - EFD20/10/7 N87 EPCOS  
 Bobbin - Horizontal 10 pin bobbin  
 Hi-pot  
 P-S 4000V AC 1 Sec  
 P-Core 4000V AC 1 Sec  
 S-Core 4000V AC 1 Sec  
 Remark -

Winding Start & Positive Rotation

BOBBIN

Winding Construction and Pin Definition

Unless otherwise specified, all dimension in mm		Rev.: A
Prepared -		20/Jul/06
Checked -	Title: Main Transformer	
Approved -	P/N:	Page 1 of 3

## 7.9 Add Parts

### 7.9.1 What is Add Parts?

Add part is a general feature applied on all tools for user to add components for analysis. If a power supply is initialized, the added part will be appended into the original power supply BOM. If no power supply is initialized, the added part will be appended into an empty BOM. All analysis tools can share that BOM for analysis purpose.

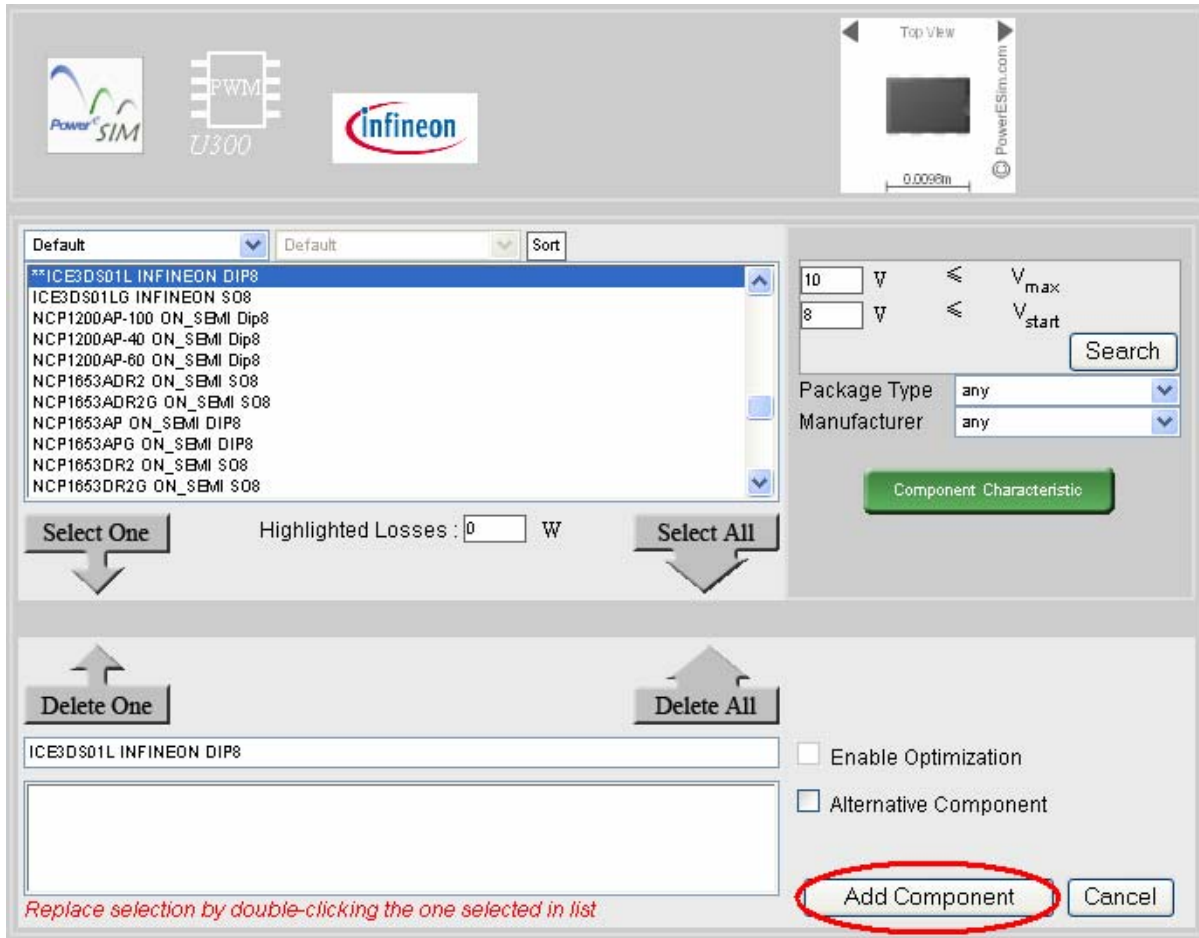
### 7.9.2 What types of parts can be added?



User should first select what type of component to be added.

### 7.9.3 Adding parts from the component database

After selecting the type of component user wanted to add, user can click on "Add" to show the interface as below.



1. Fill in the range of the searching criteria, press "Search," all the component fulfill the criteria will be displayed at the searched components box and ready to be chosen.
2. Select any one component from the searched components box
3. Click "Select One"
4. Press "Add Component" after selection

#### 7.9.4 Define the losses of the added component

The screenshot displays the software interface for defining component losses. At the top, there are logos for PowerSIM, PWM, and Infineon. Below these is a search and filter section with a list of components. The list includes:

- \*\*ICE3DS01L INFINEON DIP8
- ICE3DS01LG INFINEON S08
- NCP1200AP-100 ON\_SEMI Dip8
- NCP1200AP-40 ON\_SEMI Dip8
- NCP1200AP-60 ON\_SEMI Dip8
- NCP1653ADR2 ON\_SEMI S08
- NCP1653ADR2G ON\_SEMI S08
- NCP1653AP ON\_SEMI DIP8
- NCP1653APG ON\_SEMI DIP8
- NCP1653DR2 ON\_SEMI S08
- NCP1653DR2G ON\_SEMI S08

Below the list are buttons for 'Select One' and 'Select All'. A text box labeled 'Highlighted Losses : 0 W' is circled in red. To the right, there are search filters for 'Package Type' and 'Manufacturer', both set to 'any', and a 'Component Characteristic' button. Below the list are buttons for 'Delete One' and 'Delete All'. The 'Delete One' field contains 'ICE3DS01L INFINEON DIP8'. There are also checkboxes for 'Enable Optimization' and 'Alternative Component', and 'Add Component' and 'Cancel' buttons. A red note at the bottom reads: 'Replace selection by double-clicking the one selected in list'.

All component added from database can be enter an power losses in the “Highlighted Losses” text box for thermal analysis purpose

## 7.9.5 Create customize parts

### Create new components

Component Type

Customized Component ▾

- Select Component Type -

- Bridge
- Capacitor
- Circuit Breaker
- Connector
- Fuse
- Heat Sink
- IC
- Inductor
- Mechanical Relay
- Mosfet
- Optocoupler
- PCB
- Rectifier
- Resistor
- Shunt Regulator
- Socket
- Switch
- Thermistor
- Thyristor
- Transformer
- Transistor
- Zener
- Customized Component

1. Select "Customize component" from Component Type
2. Press "Add" and you can see the page as below

General Component

1) -

**General Properties**

Component Name  (e.g. Q1, K2)

Description  (English only)

Power losses  W

**Physical Properties**

Component Type  ▾

Package Category  ▾

Package Style  ▾

Width =  m

Thickness =  m

Height =  m

Material  ▾

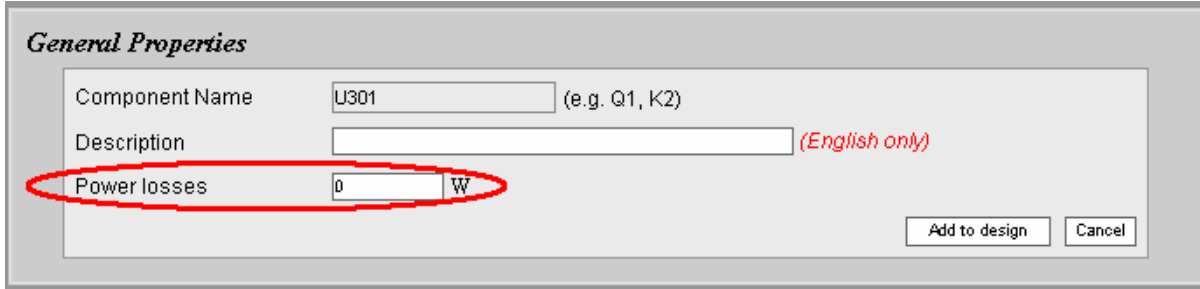
Copyright 2006 PowerESim.com. All rights reserved.

3. Select which component you want to add from "Component Type"



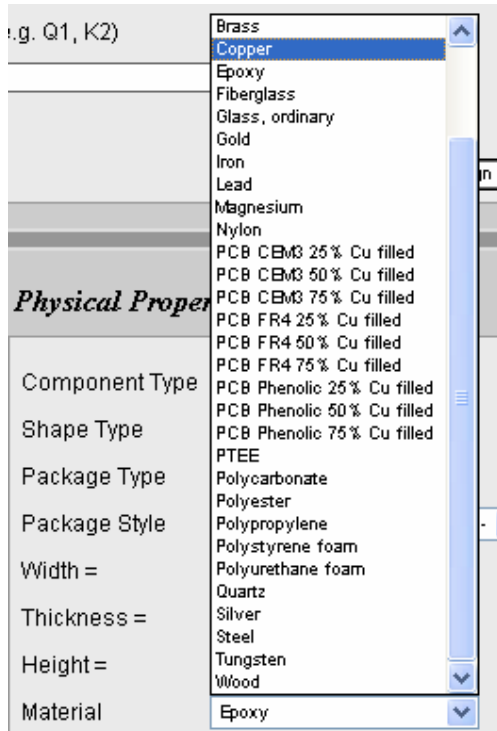
A lot of predefined package have been build to facility user. User can select the package style of the part from “Package style” combo box. The size and shape will be previewed at the left hand side. This shape will be as same as in Thermal Analyzer. No hand drawing is needed.

### 7.9.6 Define the losses of the added customize part



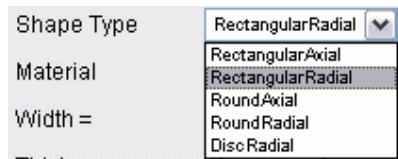
The losses of the customize part can be filled in the “Power Losses” text box.

### 7.9.7 Define the material of the customize part



User can select different material from the “Material” combo box.

### 7.9.8 How to set the shape of the customize part?



User can select from the “Shape Type” combo box to have some choice of basic shape type.

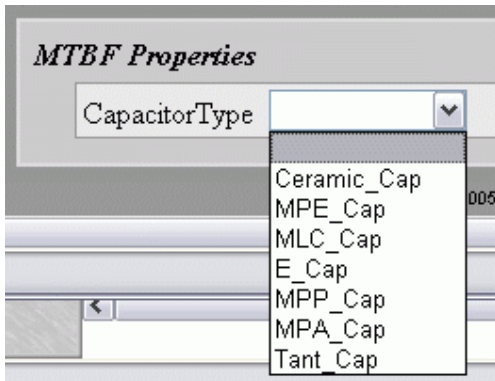


**7.9.9 How to set the size of the customize part?**

Width =  m  
 Thickness =  m  
 Height =  m

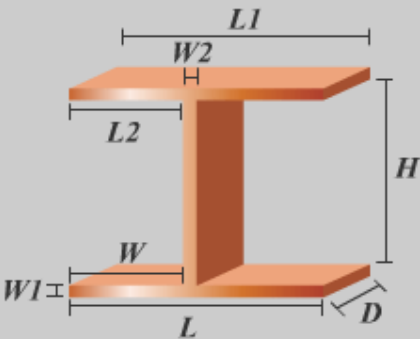
Fill in these 3 parameters to customize the size of the component.

**7.9.10 How to edit the MTBF properties of a customized capacitor?**



To add the capacitor, you can set the “Capacitor Type” at the bottom of the interface. This type is for the measurement in MTBF Analysis.

**7.9.11 Customize a heat sink**



**Physical Properties**

Heat Sink Type

Number of Fins

L =  m

H =  m

W =  m

D =  m

L1 =  m

L2 =  m

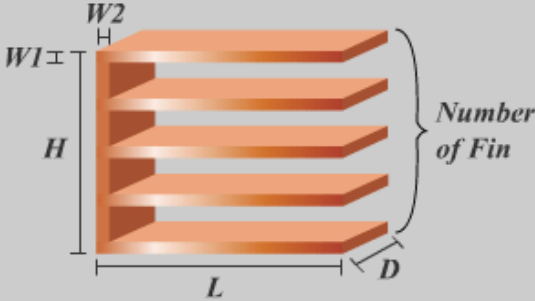
W1 =  m

W2 =  m

Material

Heat sink shape can be chosen at the “Heat Sink Type” combo box

### 7.9.12 Changing the fin of a heat sink



**Physical Properties**

Heat Sink Type: RectangularFin Shape

Number of Fins: 6

L =  m

H =  m

W =  m

D =  m

L1 =  m

L2 =  m

W1 =  m

W2 =  m

Material: Copper

Select the number of fins at “Number of Fins” combo box

### 7.9.13 Customize a PCB?

**General Properties**

Component Name: PCB301 (e.g. Q1, K2)

Description:  (English only)

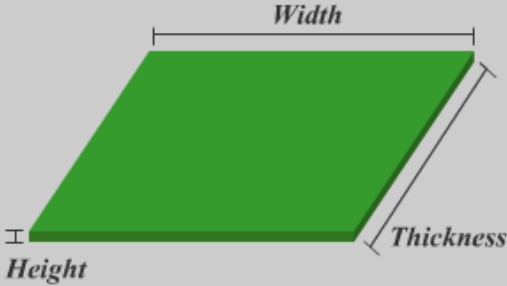
PCB Type:
 

- Non-PTH PCB, eg. Single Sided PCB
- Non-PTH PCB, eg. Single Sided PCB**
- PTH PCB, eg. Multi Layer PCB

Add to design Cancel

---

**Physical Properties**



Width =  m

Thickness =  m

Height =  m

Material: PCB FR4 50% Cu filled

Set the PCB Size and Material.

### 7.9.14 How to view or delete the added parts?

Ref	Component Type	Description	Delete
C300	Capacitor	10uF 160V 8x11.5xmm YXA RUBYCON 20%	Delete

After adding component to the design, the components will be shown in the "Add Part" interface. Click on the designator to view and edit components. Click on "Delete" to remove a component from the design.

## 7.10 Smart Optimizer

### 7.10.1 What is the Smart Optimizer? What can it do?

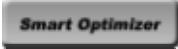
Smart optimizer navigates or iterates combinations of circuit definition (by varying pre-defined parts) and returns a number of circuit combinations in sorted order according to converter efficiency.

### 7.10.2 How to fire off the Smart Optimizer?

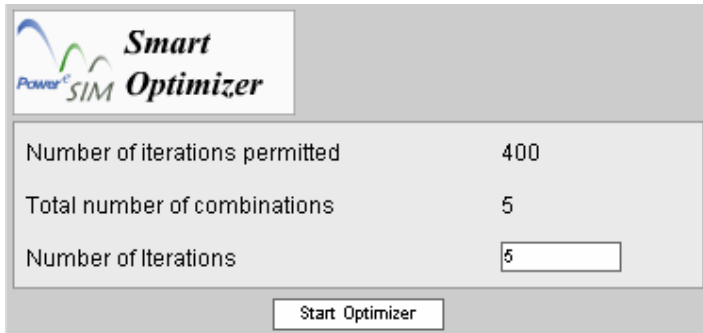
The screenshot displays the Smart Optimizer software interface. At the top, there's a logo for PowerSIM and a circuit diagram of a MOSFET. Below that, a dropdown menu shows 'No. of Mosfets in parallel' set to 1. A 'FrontView' window shows a MOSFET package with a 0.01587m scale bar. The main area contains a list of MOSFET parts, with one part selected. A red circle labeled '2' highlights the list. Below the list, there are buttons for 'Select One' (circled in red and labeled '3'), 'Select All', 'Delete One', and 'Delete All'. To the right, there are parameter fields for  $R_{ds}$  (1.08  $\Omega$ ),  $V_{ds}$  (1.66k V), and  $I_{ds}$  (10.09 A), along with a 'Search' button. Below these are 'Package Type' and 'Manufacturer' dropdowns, and buttons for 'Component Analysis' and 'Component Characteristic'. At the bottom, there's a 'Done' button circled in red and labeled '4', and a 'Cancel' button. A red circle labeled '1' highlights the 'Enable Optimization' checkbox, which is checked.

Select the part (section 5.7) you want to do optimization and see the picture as above.

1. Check "Enable Optimization"
2. Select any part from the list for optimization
3. Press "Select One", if you want to select more, repeat step 2
4. Press "Done" to confirm

After selecting parts for preparing optimization, press button  at the bottom left of the main page to fire off smart optimizer.

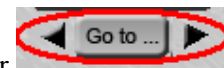
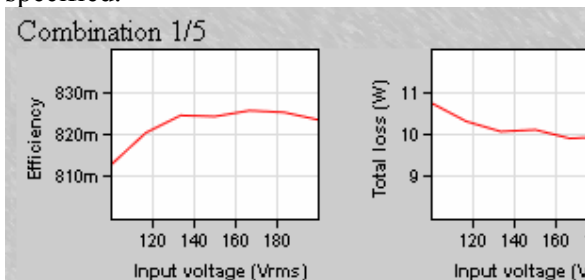
### 7.10.3 After pressing the Smart Optimizer button, a dialog box pops up and asks for number of iterations!




The number of iterations instructs smart optimizer which algorithm it should adopt for your request. Roughly speaking, more iteration provides better results and requires more processing time.

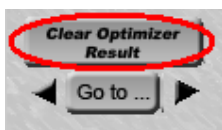
### 7.10.4 View Optimization Result

Optimization completes your request in time ranges from several seconds up to half an hour or more. It depends on total number of combinations of design definition and number of iterations specified.



After its completion, you will be notified by combination navigation bar on bottom-left panel or at the top of every analysis window similar to . You can press ◀ and ▶ to navigate among possible combinations. Alternatively, you can press “Go to” button to view the specific combination result

### 7.10.5 Clear Optimization Result



Press “Clear Optimizer Result” to remove the last optimization result.

## 8 Save and Load Design

### 8.1 Save your design

#### 8.1.1 Before selecting a topology



#### 8.1.2 After selecting a topology



### 8.2 Load design

#### 8.2.1 Before selecting a topology



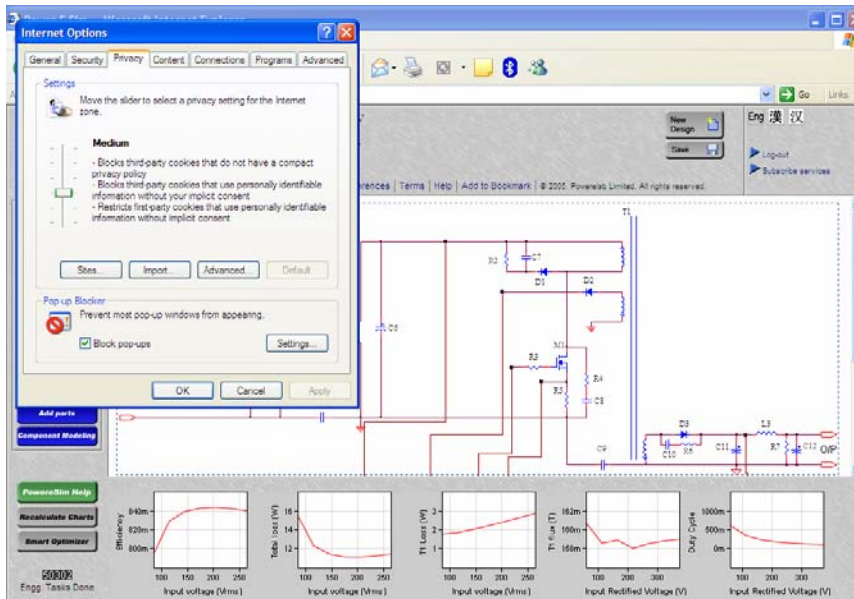
#### 8.2.2 After selecting a topology



## 9 Troubleshooting

### Run PowerEsim smoothly - security setting

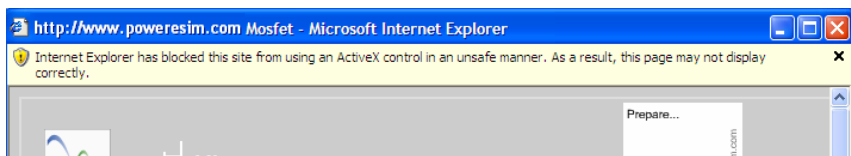
In "**Internet Options**" in IE, go to Privacy/Settings. Set the Privacy level not higher than "**Medium**" or click on "**Security**" to add the [www.powerEsim.com](http://www.powerEsim.com) as the trusted site.



### Enable ActiveX control for proper views

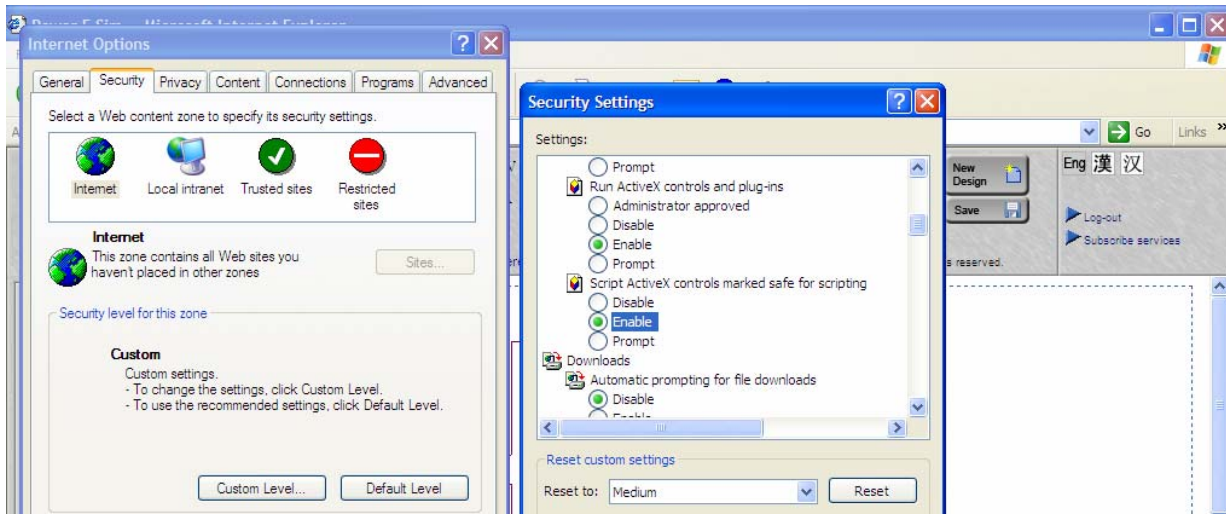
"Internet Explorer" has blocked this site from using an ActiveX control in an unsafe manner. As a result, this page may not display correctly."

When you notice the message above shown at the top banner of the browser, this mean the "ActiveX control" is constrained and some JavaScript actions and Flash movie are disabled. You have to do following things for proper views in PowerEsim.



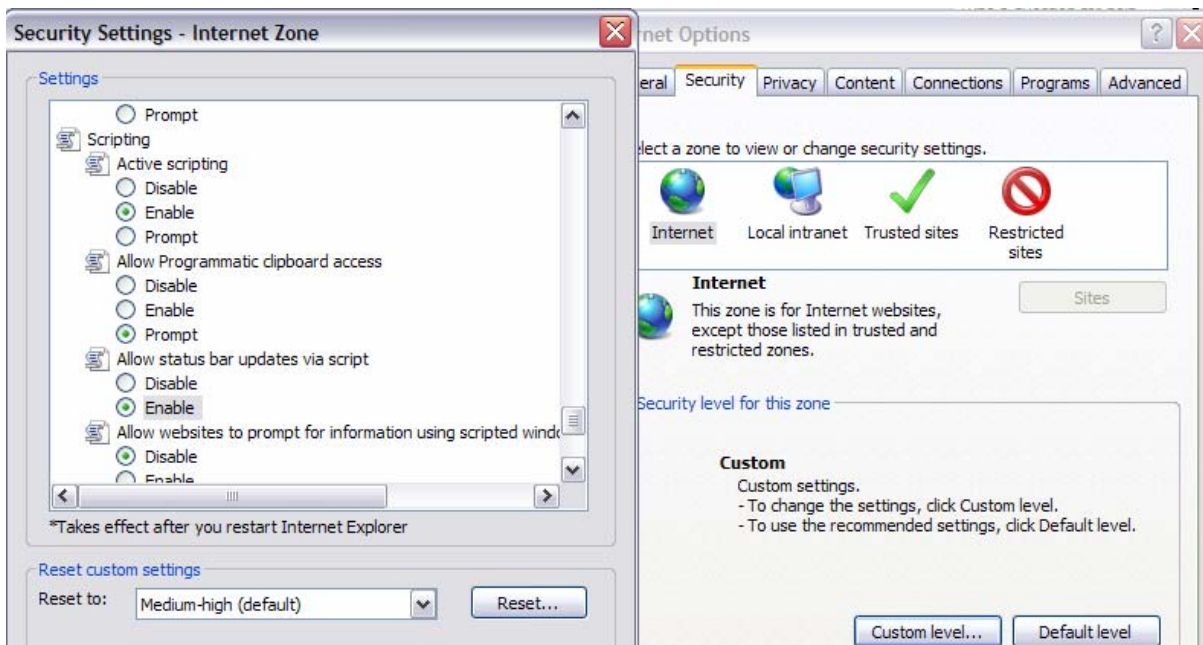
- 1) Go to "**Internet Options**" in IE
- 2) In the "**Security**", click on "**Custom Level...**"
- 3) You can find the "**Run ActiveX controls and plug-ins**" and "**Script ActiveX Control**" marked
- 4) Check both to "**Enable**"
- 5) Restart the browser





### Enable Status Bar Scripting

- 1) Open Internet Explorer, click the “**Tools**” button, click “**Internet Options**”, and then click the “**Security**” tab.
- 2) Click “**Internet or Restricted sites**”, and then click the “**Custom level**” button.
- 3) Scroll down to “**Allow status bar updates via script**”, select “**Enable**”.
- 4) Click “**OK**” until you return to Internet Explorer.





## 10 Appendix

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