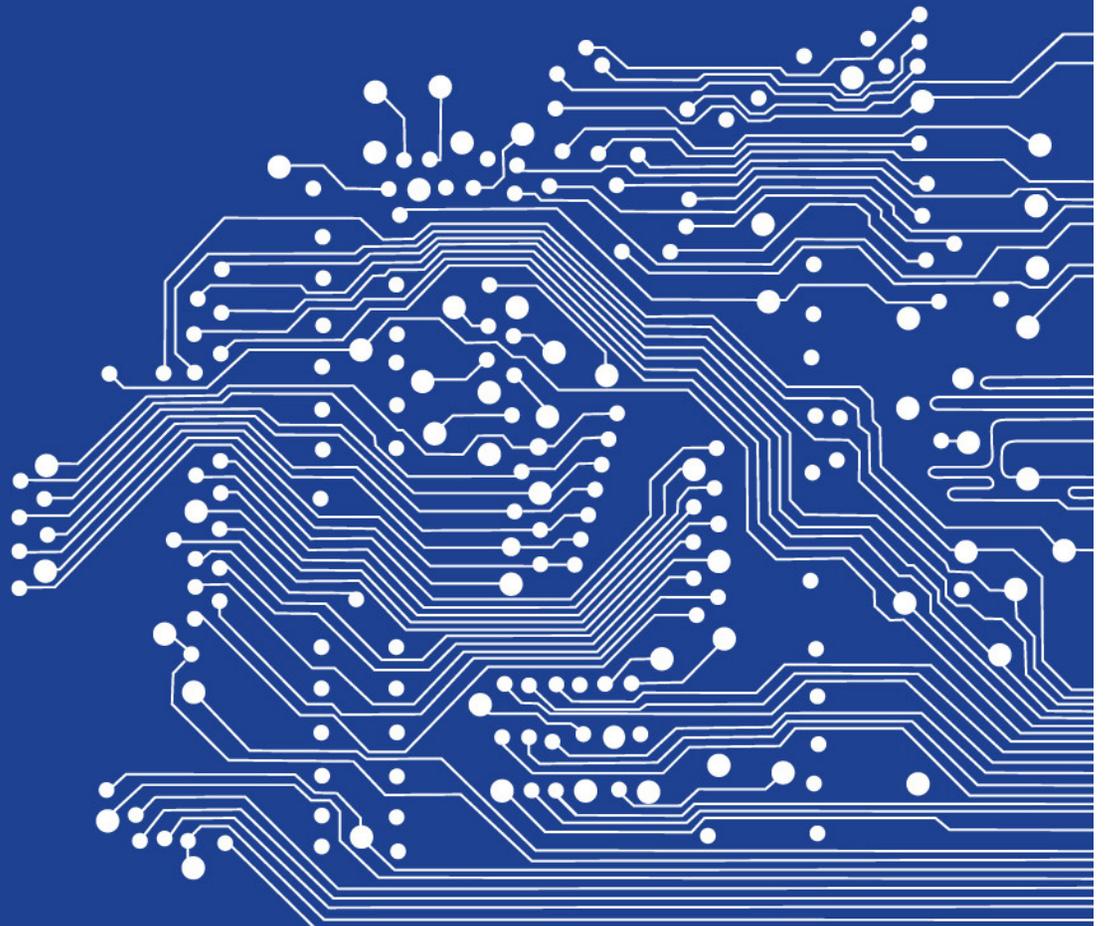


# GE Critical Power Power Module Wizard Tutorial - POLs

March 31, 2015

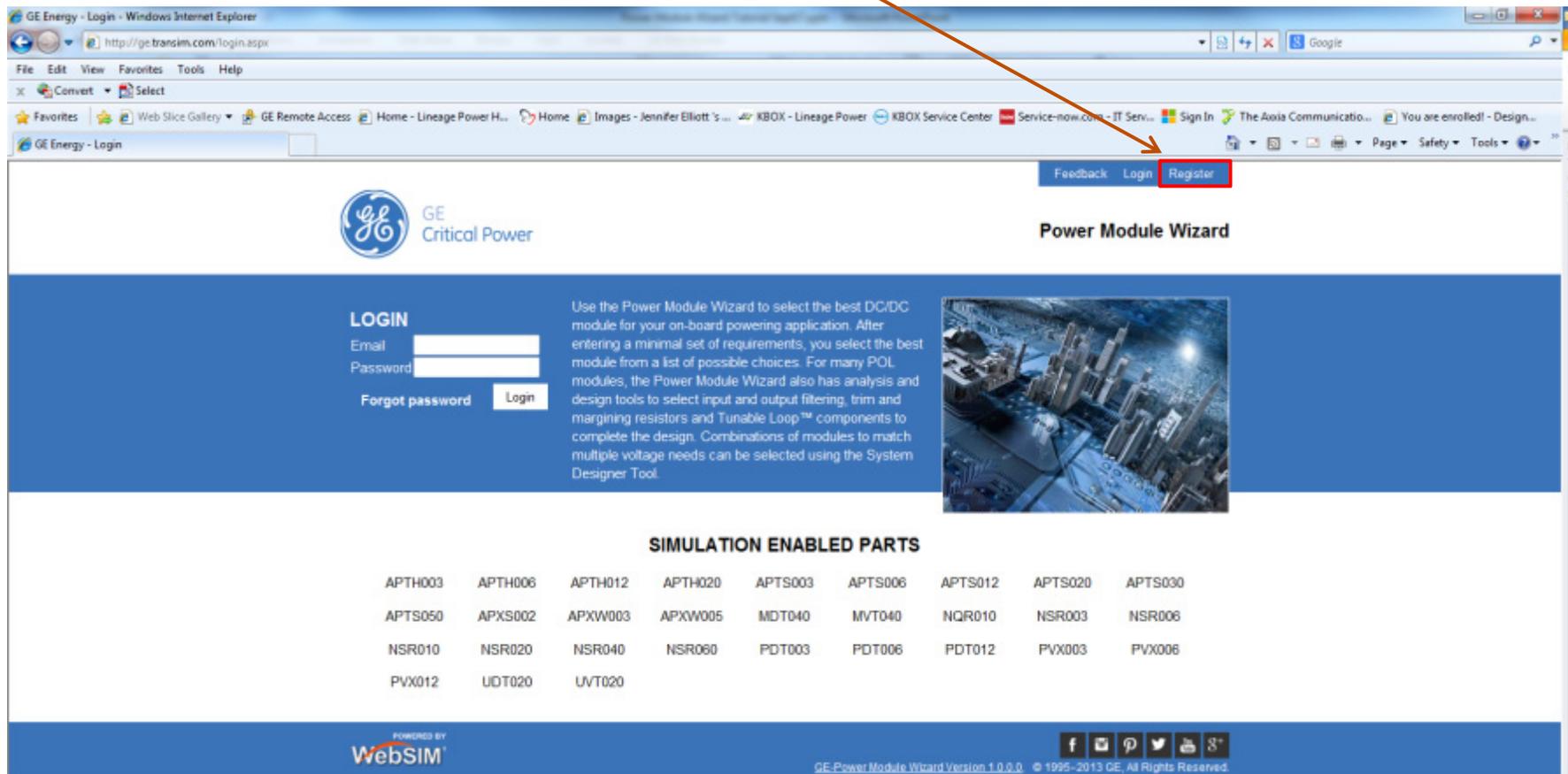


# Outline

- Registration
- Module Selector
- Basic Requirements
- Run Selector
- Tunable Loop and Voltage Programming requirements
- Simulation Schematic
- Analysis of Schematic
- Editing Schematic
- Saving Schematic and Standalone applications
- Efficiency Estimation
- BOM
- Summary Report

# Registration

- Go to <http://ge.transim.com> to register as a user
- Click on the **Register** button



GE Energy - Login - Windows Internet Explorer

http://ge.transim.com/login.aspx

Feedback Login **Register**

GE Critical Power

**Power Module Wizard**

**LOGIN**

Email

Password

[Forgot password](#)

Use the Power Module Wizard to select the best DC/DC module for your on-board powering application. After entering a minimal set of requirements, you select the best module from a list of possible choices. For many POL modules, the Power Module Wizard also has analysis and design tools to select input and output filtering, trim and margining resistors and Tunable Loop™ components to complete the design. Combinations of modules to match multiple voltage needs can be selected using the System Designer Tool.

**SIMULATION ENABLED PARTS**

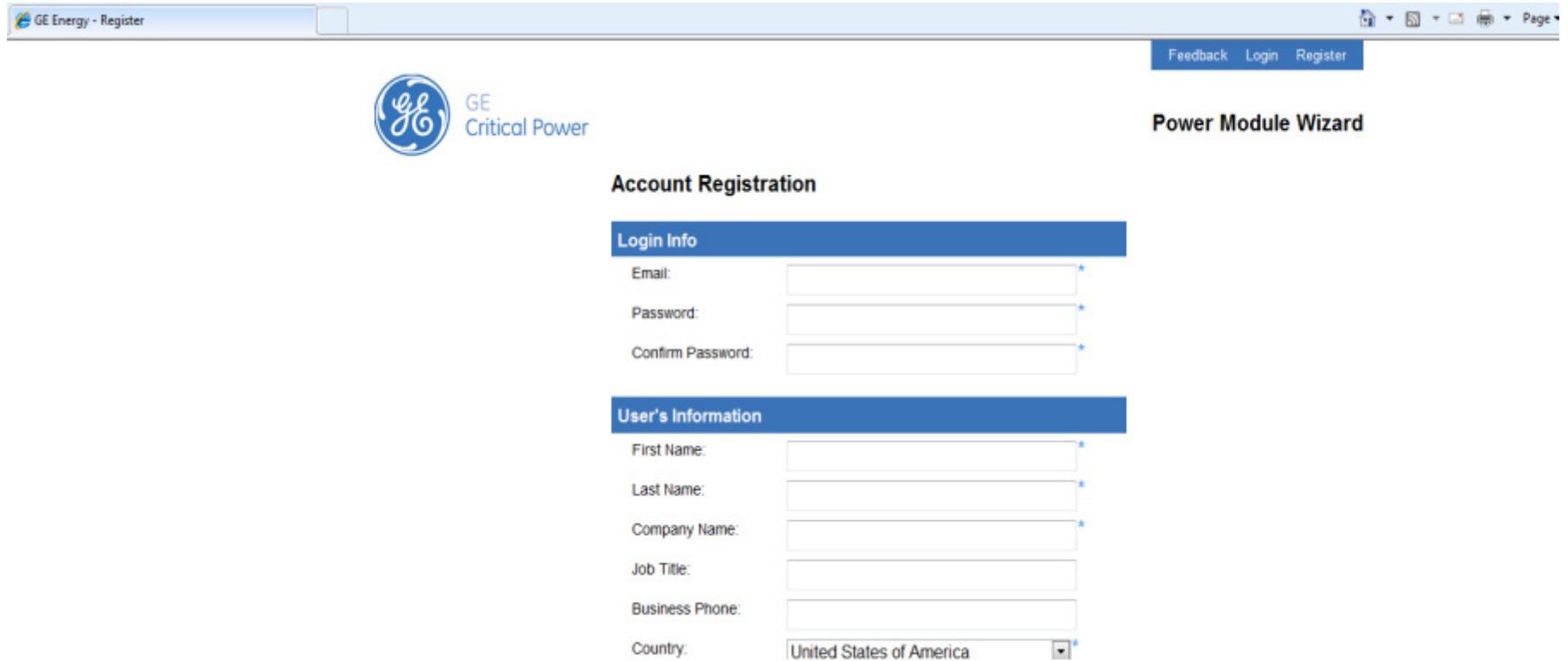
APTH003	APTH006	APTH012	APTH020	APTS003	APTS006	APTS012	APTS020	APTS030
APTS050	APXS002	APXW003	APXW005	MDT040	MVT040	NQR010	NSR003	NSR006
NSR010	NSR020	NSR040	NSR060	PDT003	PDT006	PDT012	PVX003	PVX006
PVX012	UDT020	UVT020						

POWERED BY **WebSIM**

GE Power Module Wizard Version 1.0.0.0 © 1995-2013 GE. All Rights Reserved.

# Registration

- Complete a short registration form to create an account



The screenshot shows a web browser window with the address bar displaying "GE Energy - Register". The page header includes the GE logo and "GE Critical Power" on the left, and navigation links for "Feedback", "Login", and "Register" on the right. The main heading is "Power Module Wizard". Below this is the "Account Registration" section, which is divided into two parts: "Login Info" and "User's Information".

**Account Registration**

**Login Info**

Email:

Password:

Confirm Password:

**User's Information**

First Name:

Last Name:

Company Name:

Job Title:

Business Phone:

Country:

# Begin with the Module Selector

- Start by clicking on **Module Selector**



Power Module Wizard



Please select the tool you would like to use.

Module Selector

System Designer

The Module Selector uses a small set of user requirements (Input and Output Voltage, Output current, Min. Airflow, Max. Temp. and Height) to display a list of suitable DC-DC modules. The list can be sorted and/or filtered to find the best module for the application. Both isolated and non-isolated modules are supported.

For most non-isolated (POL) modules, an extensive analysis capability is provided with Web-based and offline simulation capability. This, with the POL Programming and Tunable Loop tools, helps the designer build up the design around the selected POL. A BOM can then be generated along with a summary report.

All design information can be stored and shared with other users as well.

The System Designer helps find suitable solutions for powering multiple voltage rails on a board. After entering the input voltage, different load voltages and currents, and Min. Airflow, Max. Temp. and Height, one or more solution choices are provided.

Applications requiring combinations of isolated and non-isolated modules can be entered, along with specifying whether a bus or hybrid powering architecture is preferred.

In many cases, the user may be able to find a wider choice of solutions by selecting a module at a time, so if the System Designer does not yield a solution, try using the Module Selector to find more choices.

# Basic Requirements

- Enter first level of requirements and then click on **Find Solutions**

**GE Critical Power** **Power Module Wizard**

Home | **1 Part Selection** | 2 Design Requirements | 3 Analyze | 4 BOM | 5 Summary | Help

> Module Selector

### Electrical Requirements

Non\_Isolated  
 Isolated

Single Ouput  
 Double Ouput

Vin:  (V)

Vout:  (V)

Iout\_max:  (A)

### Environmental Requirements

Metric Units  
 English Units

Maximum Ambient Temp.:  (°C)

Minimum Airflow:  (m/s)

Max. Height:  (mm)

### Ranking Preferences

Less Important More Important

Cost:

Area:

Efficiency:

### Solutions

Rank	Rel. Cost	Part Number	Analysis	Vin (V)		Vout (V)		Iout Max (A)	Iout Derate (A)	Board Area (cm <sup>2</sup> )	Effic. at Iout Derate (%)	Height (mm)	Mounting	Package	Digital Interface	Number of Parallel Modules
				Min	Max	Min	Max									

# Filters available to sort product list

- The Listed set of Solutions can be filtered based on
  - Digital Interface,
  - Package Size,
  - Mounting
  - Output Voltage
  - Input Voltage

Rank	Rel. Cost	Part Number	Analysis	Vin (V)		Vout (V)		Max Iout (A)	Iout Derated (A)	Board Area (cm <sup>2</sup> )	Effic. at Iout-max (A)	Height (mm)	Mounting	Package	Digital Interface	Number of Parallel Modules
				Min	Max	Min	Max									
			Any	3 - 14.4	14.4	0.45 - 5.5	5.5						Any	Any	Any	
1	20.3 %	PDT012A0X3-SRZ	Analyze	3	14.4	0.45	5.5	12	12.00	1.486	90.5	8.4836	SMT	Lynx	Y	1
2	0 %	PVX012A0X3-SRZ	Analyze	3	14.4	0.6	5.5	12	12.00	1.486	90.0	8.4836	SMT	Pico Dlynx SMT	N	1
3	11.93 %	PVX012A0X3-SRDZ	Analyze	3	14.4	0.6	5.5	12	12.00	1.486	90.0	8.4836	SMT	Pico Dlynx SMT	N	1
4	34.71 %	PDT012A0X3-SRDZ	Analyze	3	14.4	0.45	5.5	12	12.00	1.486	90.5	8.4836	SMT	Pico Dlynx SMT	Y	1
5	32.1 %	UVT020A0X3-SRZ	Analyze	3	14.4	0.6	5.5	20	20.00	2.323	90.2	8.4836	SMT	MicroDlynx SMT	N	1
6	46.64 %	UVT020A0X3-SRDZ	Analyze	3	14.4	0.6	5.5	20	20.00	2.323	90.2	8.4836	SMT	MicroDlynx SMT	N	1

# Solutions

- Select the lowest cost solution offered
- Click on the **Analyze** function of the tool

**> Module Selector**

**Electrical Requirements**

Non\_Isolated     Single Output

Isolated     Double Output

Vin:  (V)

Vout:  (V)

Iout-max:  (A)

**Environmental Requirements**

Metric Units     English Units

Maximum Ambient Temp.:  (°C)

Minimum Airflow:  (m/s)

Max. Height:  (mm)

**Ranking Preferences**

Less Important    More Important

Cost:

Area:

Efficiency:

**Find Solutions**

**Solutions**

Rank	Rel. Cost	Part Number	Analysis	Vin (V)		Vout (V)		Iout Max (A)	Iout Derate (A)	Board Area (cm <sup>2</sup> )	Effic. at Iout Derate (%)	Height (mm)	Mounting	Package	Digital Interface	Number of Parallel Modules
				Min	Max	Min	Max									
<input type="button" value="↑"/>	<input type="button" value="↓"/>	<input type="button" value="↑"/>	Any	<input type="button" value="↑"/>	<input type="button" value="↓"/>	<input type="button" value="↑"/>	Any	Any	Y	<input type="button" value="↑"/>						
				3 - 14.4		0.45 - 5.5										
				3    14.4		0.45    5.5										
1	0 %	PDT012A0X3-SRZ	Analyze	3	14.4	0.45	5.5	12	12.00	1.486	90.5	8.4836	SMT	Pico DLynx SMT	Y	1
2	11.97 %	PDT012A0X3-SRDZ	Analyze	3	14.4	0.45	5.5	12	12.00	1.486	90.5	8.4836	SMT	Pico DLynx SMT	Y	1
3	30.22 %	UDT020A0X3-SRZ	Analyze	3	14.4	0.45	5.5	20	20.00	2.323	90.2	8.4836	SMT	MicroDLynx SMT	Y	1
4	44.47 %	UDT020A0X3-SRDZ	Analyze	3	14.4	0.45	5.5	20	20.00	2.323	90.2	8.4836	SMT	MicroDLynx SMT	Y	1
5	138.31 %	MDT040A0X3-SRPHZ	Analyze	4.5	14.4	0.45	2	40	40.00	4.445	91.6	10.8966	SMT	MegaDLynx SMT	Y	1
6	164.65 %	MDT040A0X3-SRPHDZ	Analyze	4.5	14.4	0.45	2	40	39.25	4.445	91.6	10.8966	SMT	MegaDLynx SMT	Y	1

6 Products Found.

# Tunable Loop Part Selection

- Run the Tunable Loop Tool after changing the  $\Delta V_{out}$  to 25mV from the drop down selection and entering a  $\Delta I_{out}$  of 3A. Press the **Calculate** button after the above 2 steps

PDT012A0X3-SRZ:

### Tunable Loop Tool

Maximum Allowed $\Delta V_{out}$	25	mV
Maximum $\Delta I_{out}$	3	A
Number of 47 $\mu$ F Ceramic Caps		
Number of 330 $\mu$ F Polymer Caps		
CTUNE		
RTUNE		
<b>Calculate</b>		

→

PDT012A0X3-SRZ:

### Tunable Loop Tool

Maximum Allowed $\Delta V_{out}$	25	mV
Maximum $\Delta I_{out}$	3	A
Number of 47 $\mu$ F Ceramic Caps	3	
Number of 330 $\mu$ F Polymer Caps	1	
CTUNE	3300pF	
RTUNE	270 $\Omega$	
<b>Calculate</b>		

- The tool provides the Ctune and Rtune values to achieve the desired  $\Delta v_{out}$ .

# POL Programming Tool

- Run the POL Programming Tool after changing the Margin to 5% and selecting the accuracy of the Rtrim resistor as 0.1% from the drop down selection 4.5mA. Press the **Calculate** button after the above 2 steps

**POL Programming Tool** Schematic Image

Trim and Margin Resistors	Setting Output Voltage	Output Voltage Tolerance Analysis	Voltage Programming
Trim Resistor	<input type="text" value=""/>	MIN. NOM. MAX. Tolerance	RG <input type="text" value="100000"/>
Output Voltage <input type="text" value="1.8"/> V	Rmargin_up <input type="text" value="280000"/>	Ref over temp	VO, Low <input type="text" value="1.7"/>
Margin <input type="text" value="5"/> %	Rmargin_down <input type="text" value="1620000"/>	Rupper	VO, High <input type="text" value="1.9"/>
RTrim <input type="text" value=""/>	Output Voltage <input type="text" value=""/>	Rtrim <input type="text" value="0.1%"/>	VG, Low
Rmargin_up <input type="text" value=""/>	Vout (Trim up) <input type="text" value=""/>	$\Delta$ line/load	VG, High
Rmargin_down <input type="text" value=""/>	Vout (Trim down) <input type="text" value=""/>	Vo	VG, Nom

**Calculate**

**POL Programming Tool** Schematic Image

Trim and Margin Resistors	Setting Output Voltage	Output Voltage Tolerance Analysis	Voltage Programming
Trim Resistor	<input type="text" value="10000.00"/>	MIN. NOM. MAX. Tolerance	RG <input type="text" value="100000"/>
Output Voltage <input type="text" value="1.8"/> V	Rmargin_up <input type="text" value="133333"/>	Ref over temp 0.594 0.6 0.606 1.000%	VO, Low <input type="text" value="1.7"/>
Margin <input type="text" value="5"/> %	Rmargin_down <input type="text" value="246666"/>	Rupper 19965 20000 20035 0.100%	VO, High <input type="text" value="1.9"/>
RTrim <input type="text" value="10000.00"/>	Output Voltage <input type="text" value="1.800"/>	Rtrim 9982.50 10000 10017.50 0.1%	VG, Low <input type="text" value="1.1"/>
Rmargin_up <input type="text" value="133333.33"/>	Vout (Trim up) <input type="text" value="1.890"/>	$\Delta$ line/load -0.004 0.004	VG, High <input type="text" value="0.1"/>
Rmargin_down <input type="text" value="246666.67"/>	Vout (Trim down) <input type="text" value="1.710"/>	Vo 1.755 -1.947% 1.800 1.835 1.965%	VG, Nom <input type="text" value="0.6"/>

**Calculate**

- Enter the tool calculated values of Rmargin\_up and Rmargin\_down in the corresponding fields under Setting Output Voltage and press **Calculate** again to get the Vout(Trim up)/Vout (Trim down) values

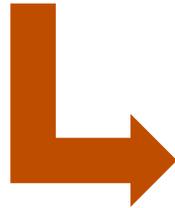
# Schematic for Simulation

- Click on **Create Design** to generate schematic

## Operational Parameters

Vin	12	V
Vout	1.8	V
Iout-max	9	A

↗ Create Design



## Configure and Simulate : PDT012A0X3-SRZ

Schematic Download Efficiency

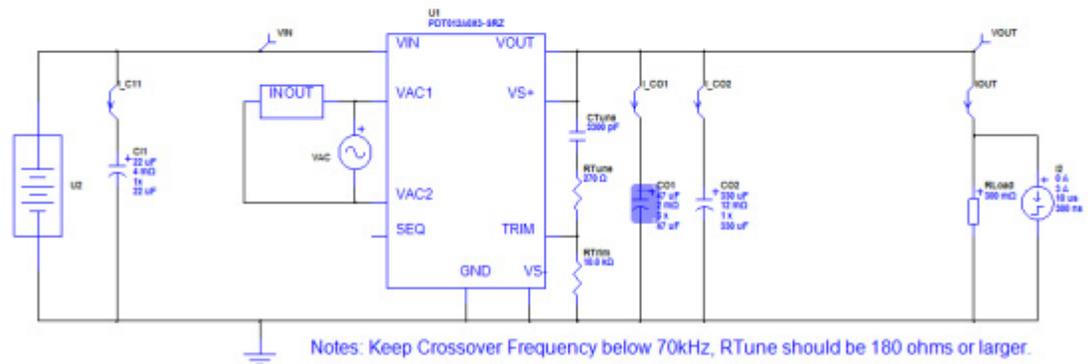
### Circuit Parameters and Configuration

▶ Stability Analysis (Averaged)

▶ Load Transient (Averaged)

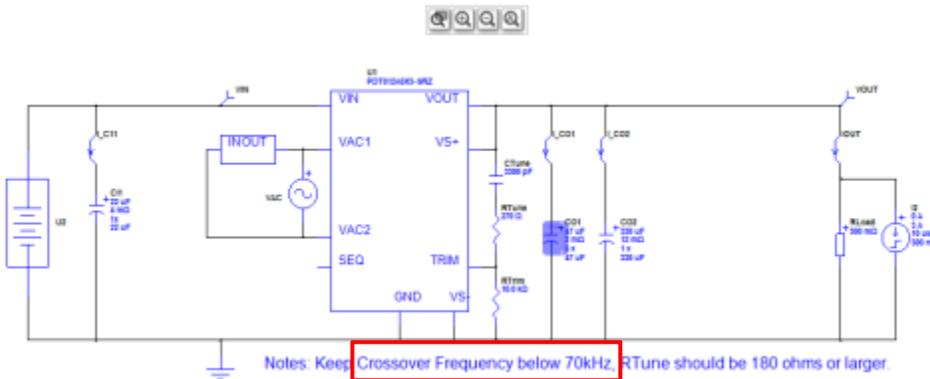
▶ Load Transient (Switched)

▶ Ripple Current & Voltage

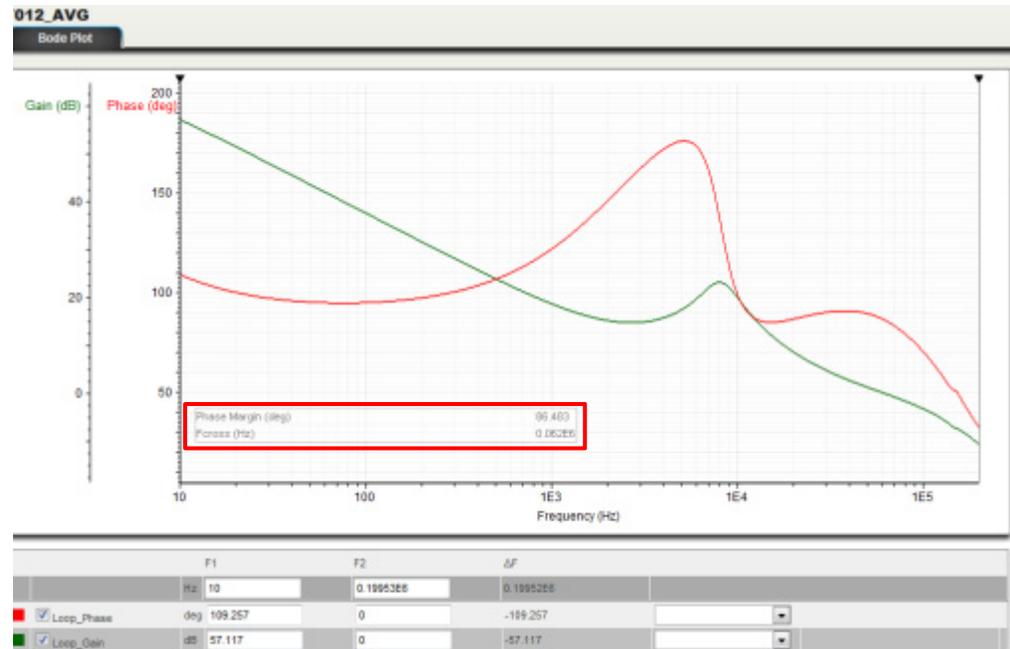


# Schematic Based Simulations

- Stability Analysis using Schematic

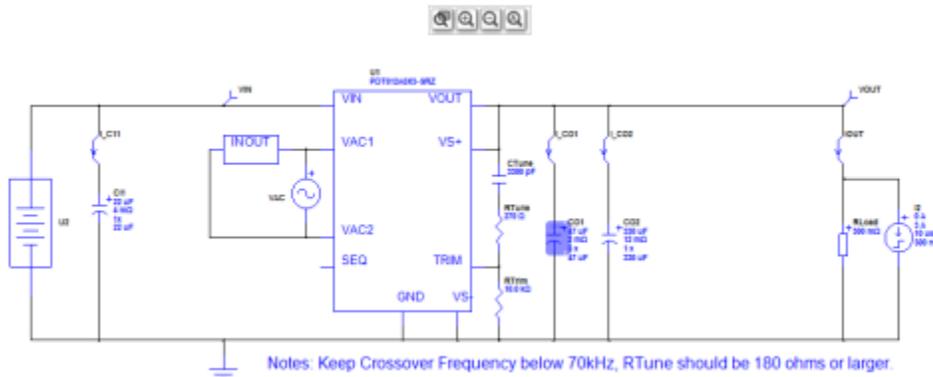


Check value of crossover frequency is below recommend value and phase margin >45 deg

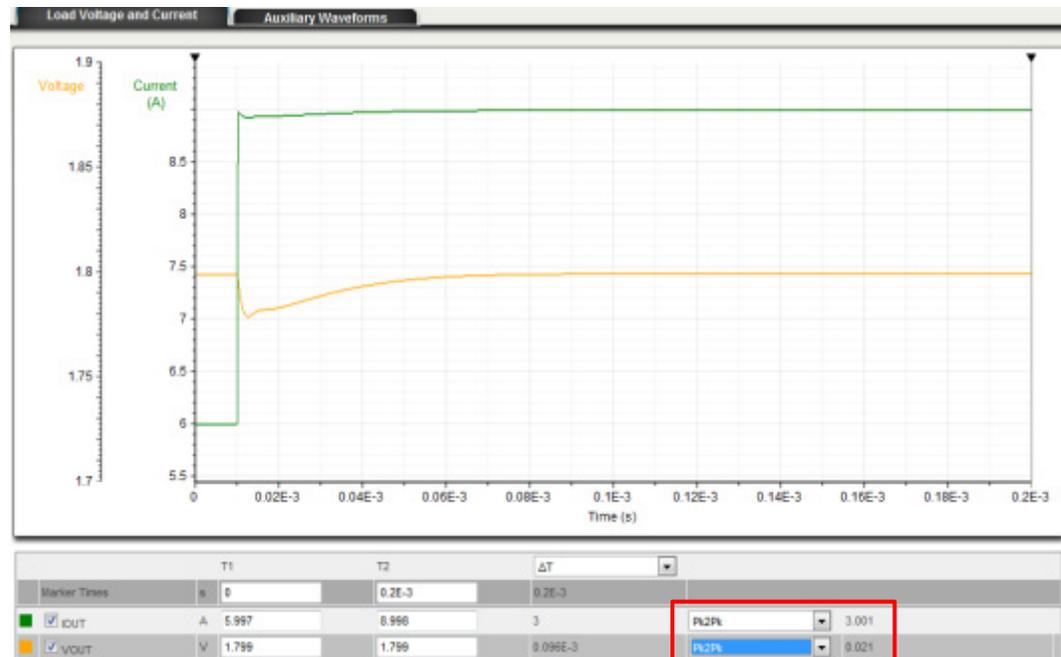


# Schematic Based Simulations

- Averaged load transient simulation using Schematic

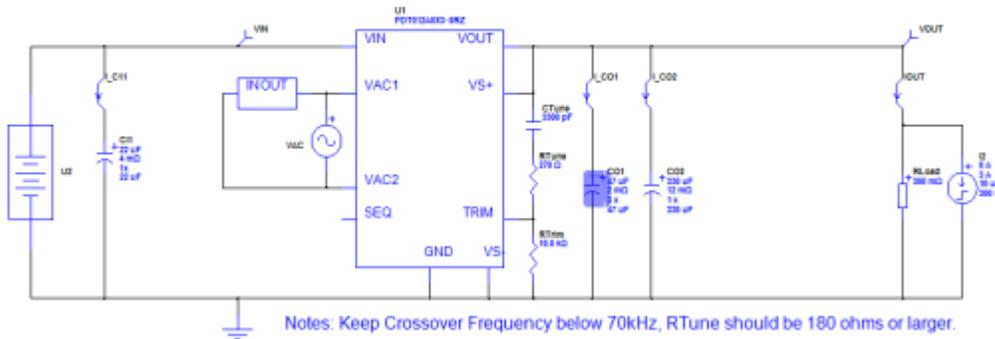


Check pk-pk value of Vout is below design requirement of 25mV by selecting PK-PK from the measurement drop down menu.

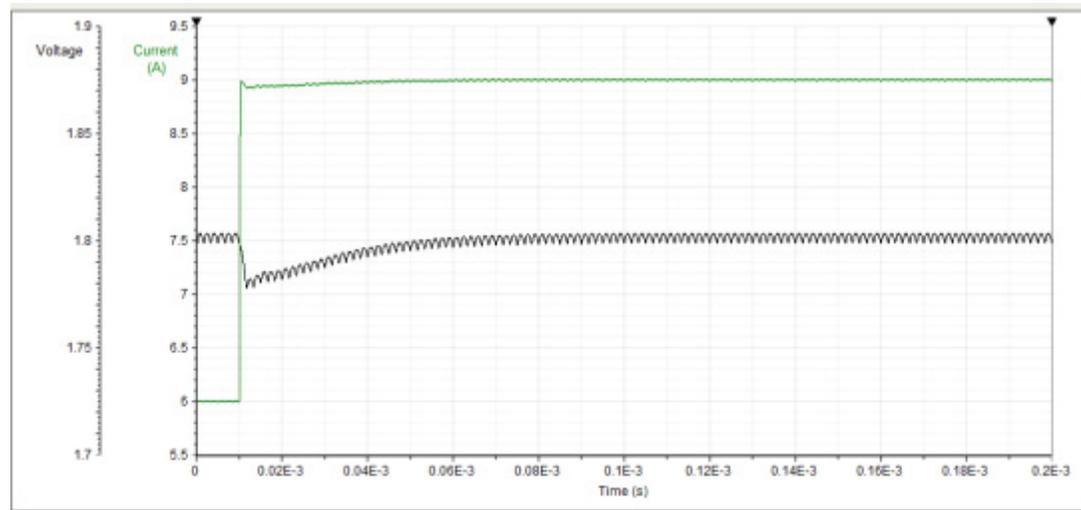


# Schematic Based Simulations

- Switched Load Transient simulation using Schematic



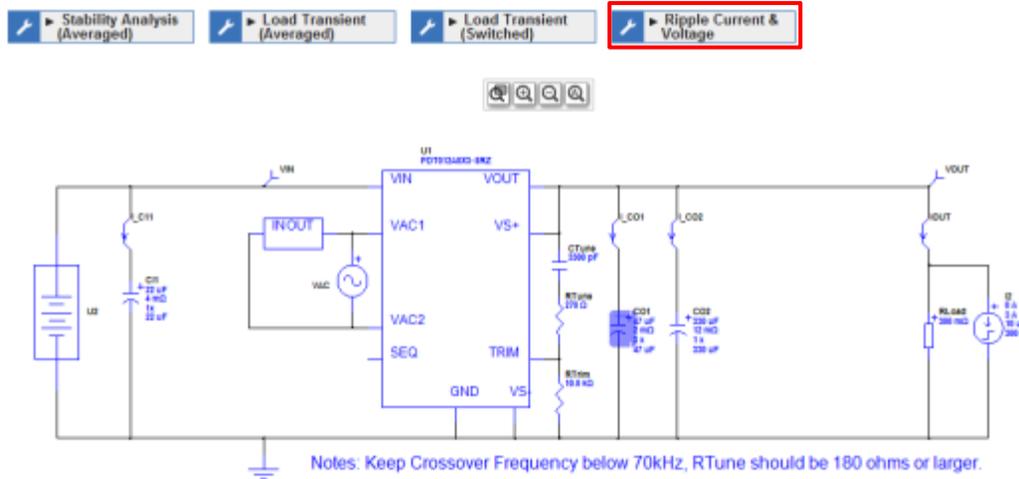
Check pk-pk value of Vout is close to design requirement of 25mV by selecting PK-PK from the measurement drop down menu.



Marker Times	T1	T2	ΔT	
0	0.02E-3	0.2E-3	0.2E-3	
<input checked="" type="checkbox"/> IOUT	A	5.996	8.996	3
<input checked="" type="checkbox"/> VOUT	V	1.799	1.799	-0.477E-6
				PK2Pk: 3.015
				PK2Pk: 0.026

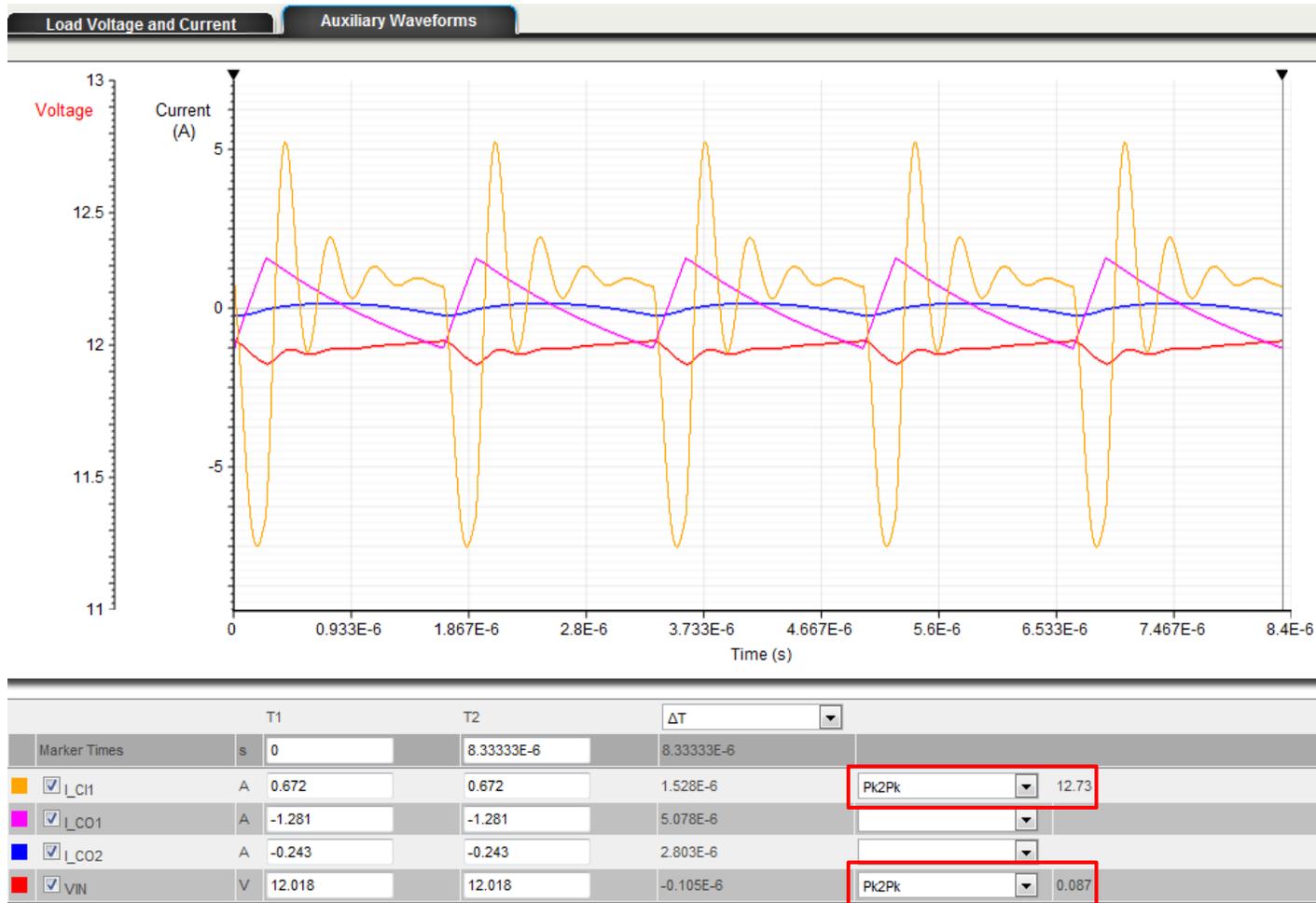
# Schematic Based Simulations

- Input Ripple Current and Voltage simulation based on schematic. Click on the Ripple Current and Voltage button



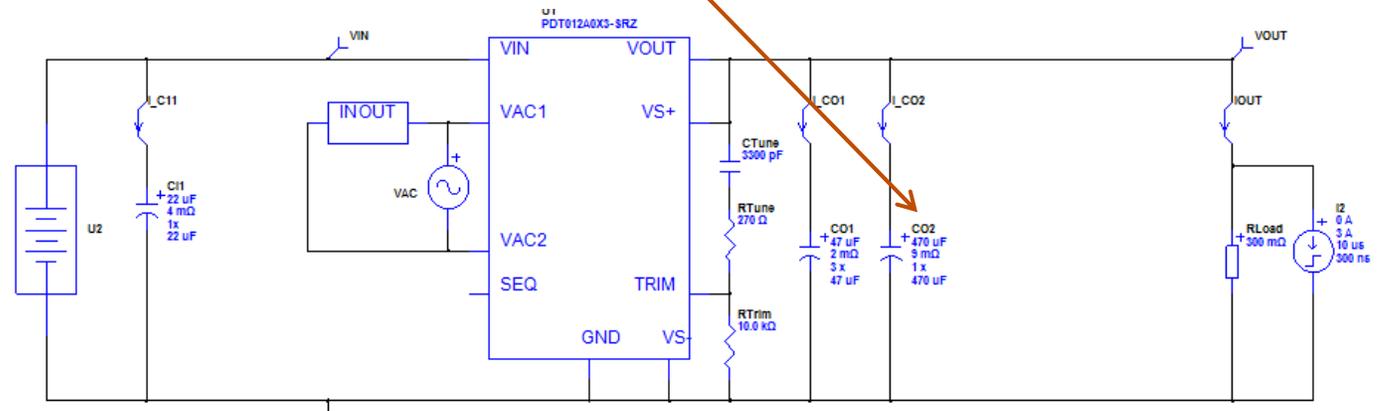
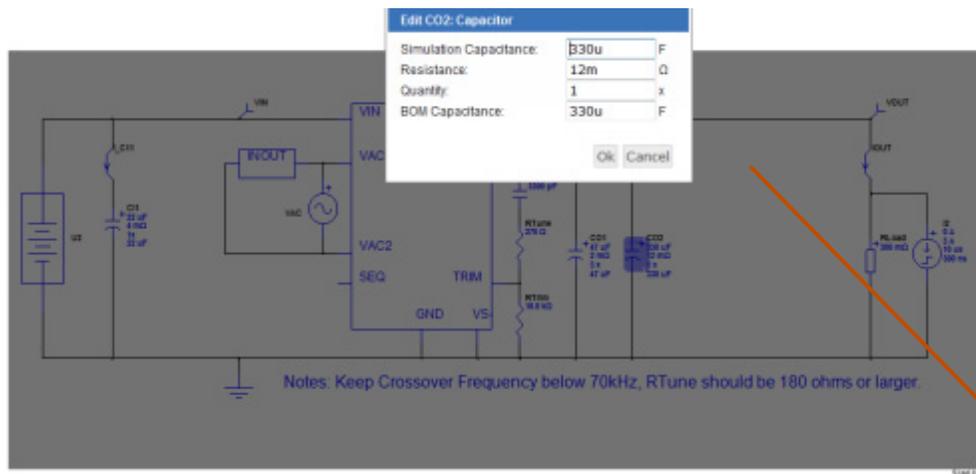
# Schematic Based Simulations

- Click on the Auxiliary Waveforms Tab and select PK-PK from the measurement drop down menu for I-CI1 and VIN



# Modifying Schematic

- Click on Capacitor Bank CO2 to bring up window to change capacitance, resistance, quantity associated with it. Values entered are 470uF capacitance, 9mohm ESR. Simulation Capacitance is derived from reviewing capacitance curves to check for correction to capacitance based on bias voltage, temperature, etc. Next run the simulations again to check for variance



# Download the schematic and simulation files

- Select the 'Download' Tab next to the 'Schematic' tab on the Screen. Click on the 'Download GE Power Module Wizard Simulator' to install a copy of the tool on the local hardware. Once that process is completed, download the Stability Analysis, Load Transient (Averaged), Load Transient (Switched) and Ripple Current and Voltage files on the local hard drive as well

Schematic **Download** Efficiency

---

 **GE Power Module Wizard Simulator**

**Download Schematic to use offline with GE PMW Simulator (Node restricted Simetrix/Simplis):**

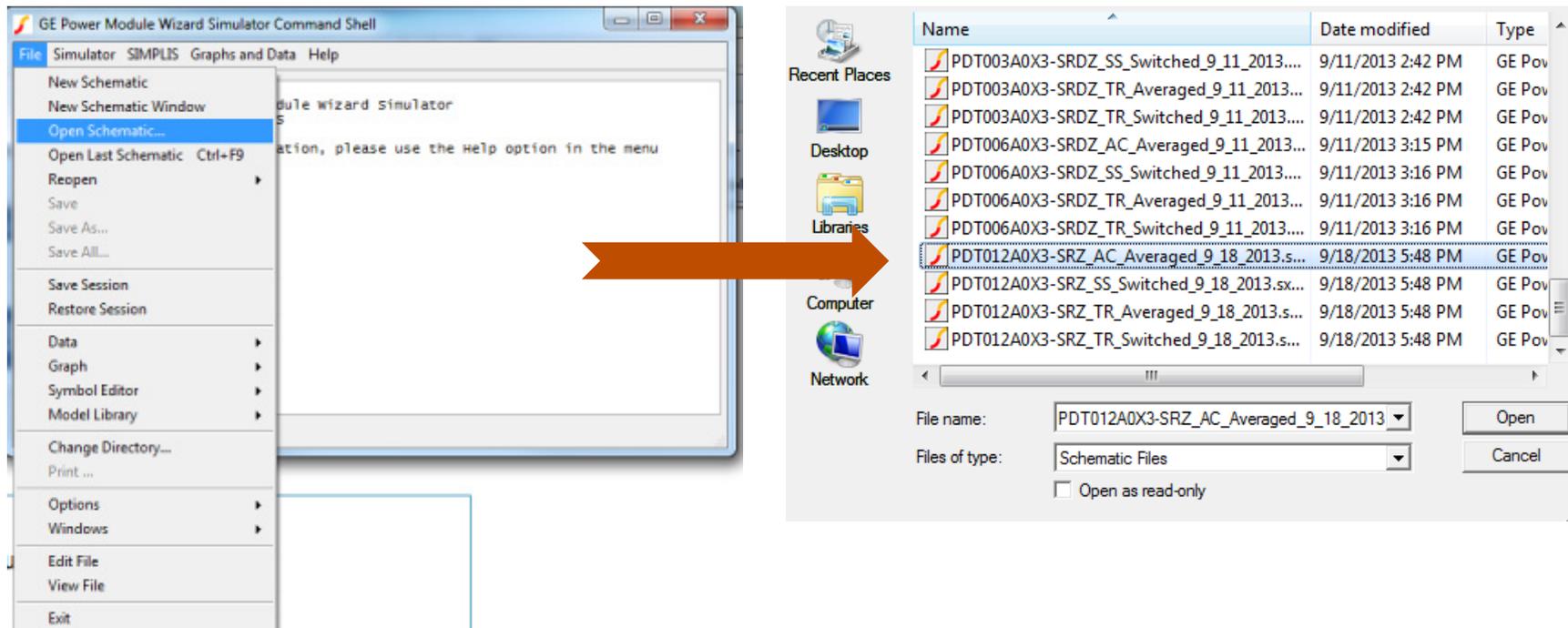
Analysis	Files
Stability Analysis (Averaged)	PDT012A0X3-SRZ_AC_Averaged_9_18_2013
Load Transient (Averaged)	PDT012A0X3-SRZ_TR_Averaged_9_18_2013
Load Transient (Switched)	PDT012A0X3-SRZ_TR_Switched_9_18_2013
Ripple Current & Voltage	PDT012A0X3-SRZ_SS_Switched_9_18_2013

**Download GE PMW Simulator:**

[Download GE Power Module Wizard Simulator](#)

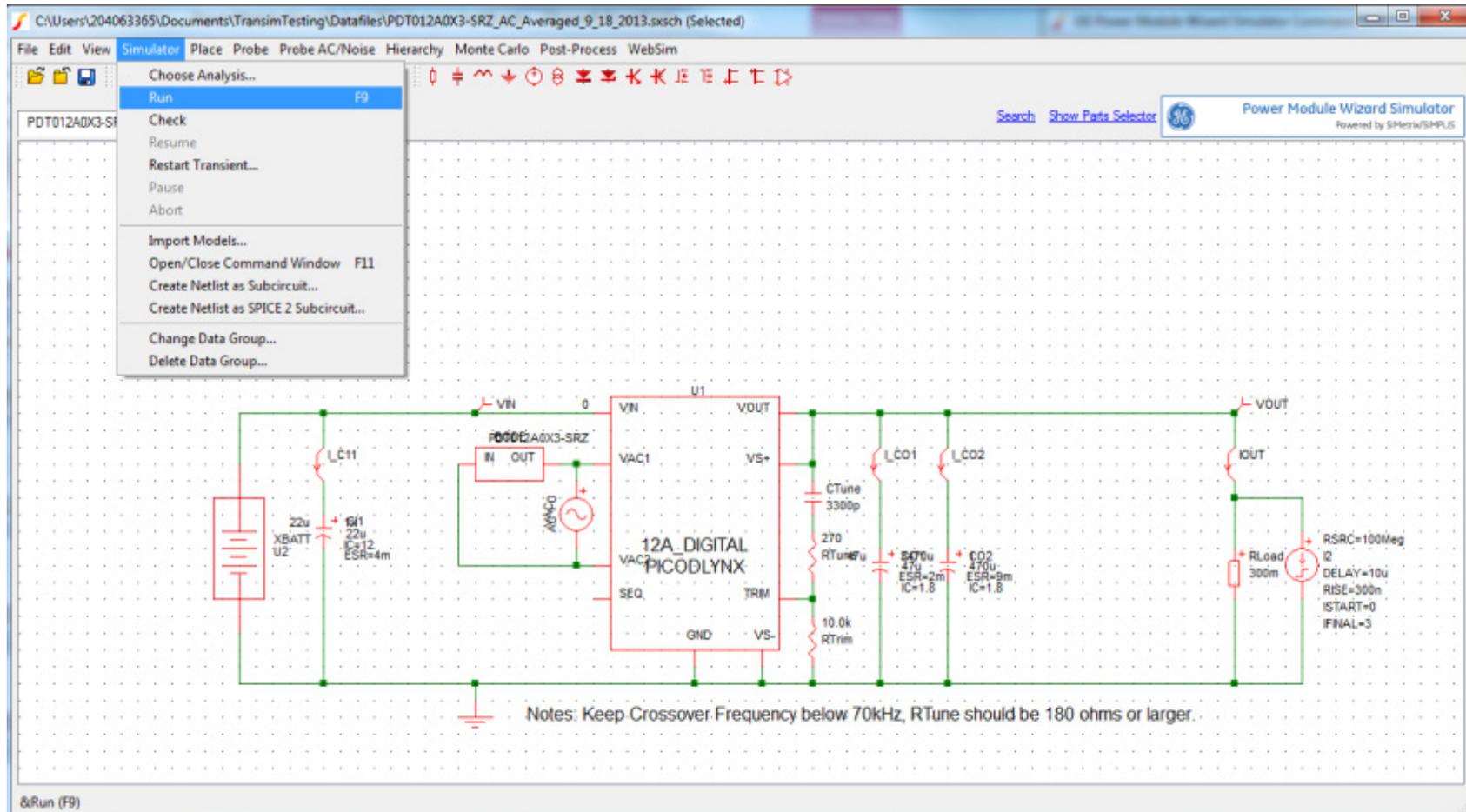
# Using the downloaded tool and files

- Once the download is complete, start the GE Power Module Wizard Simulator. Then Under the drop down menu under 'File' select 'Open Schematic' and open the xxx\_AC\_Averaged\_xxx file.



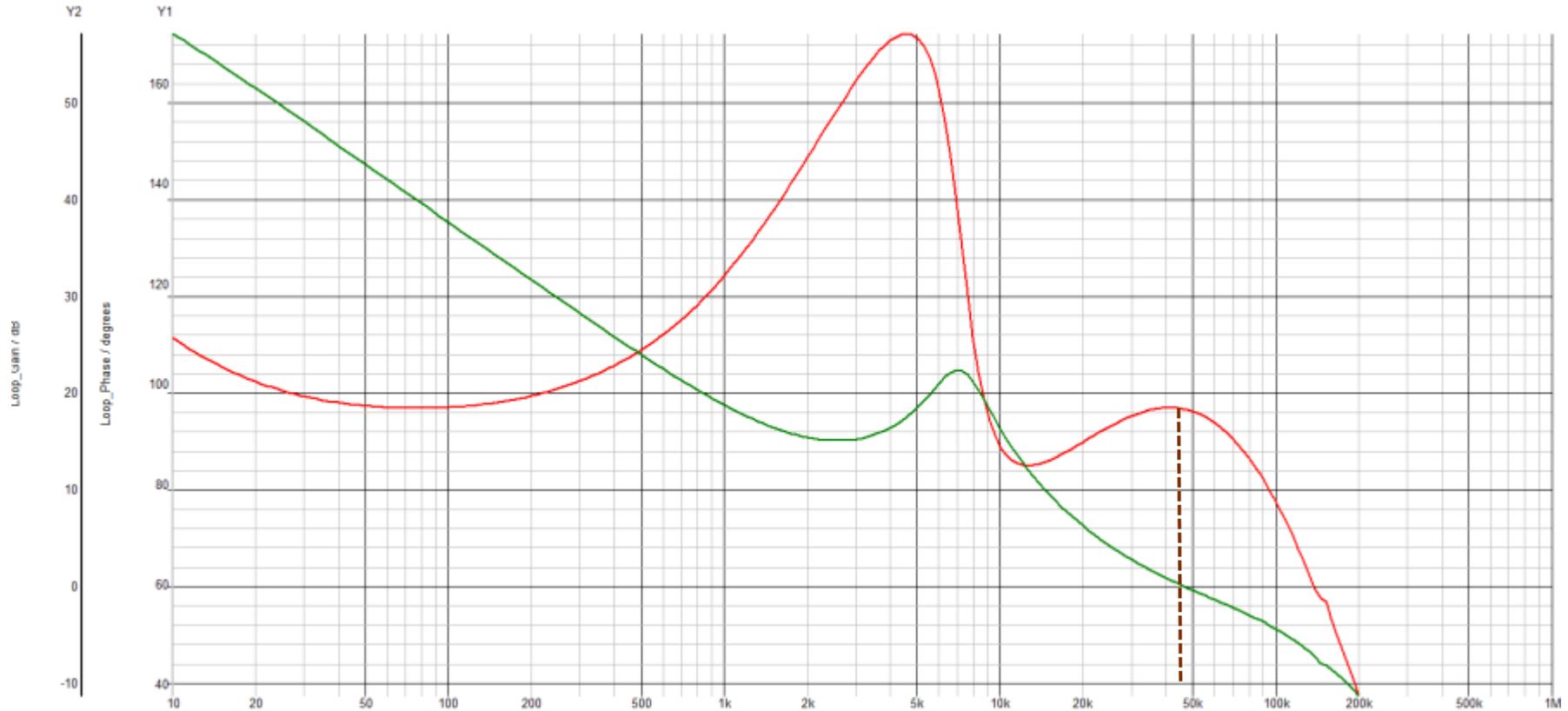
# Using the downloaded tool and files

- Once the file is visible on the screen use Function key F9 or choose Run from the dropdown menu under the 'Simulator' Tab in the menu.



# Using the downloaded tool and files

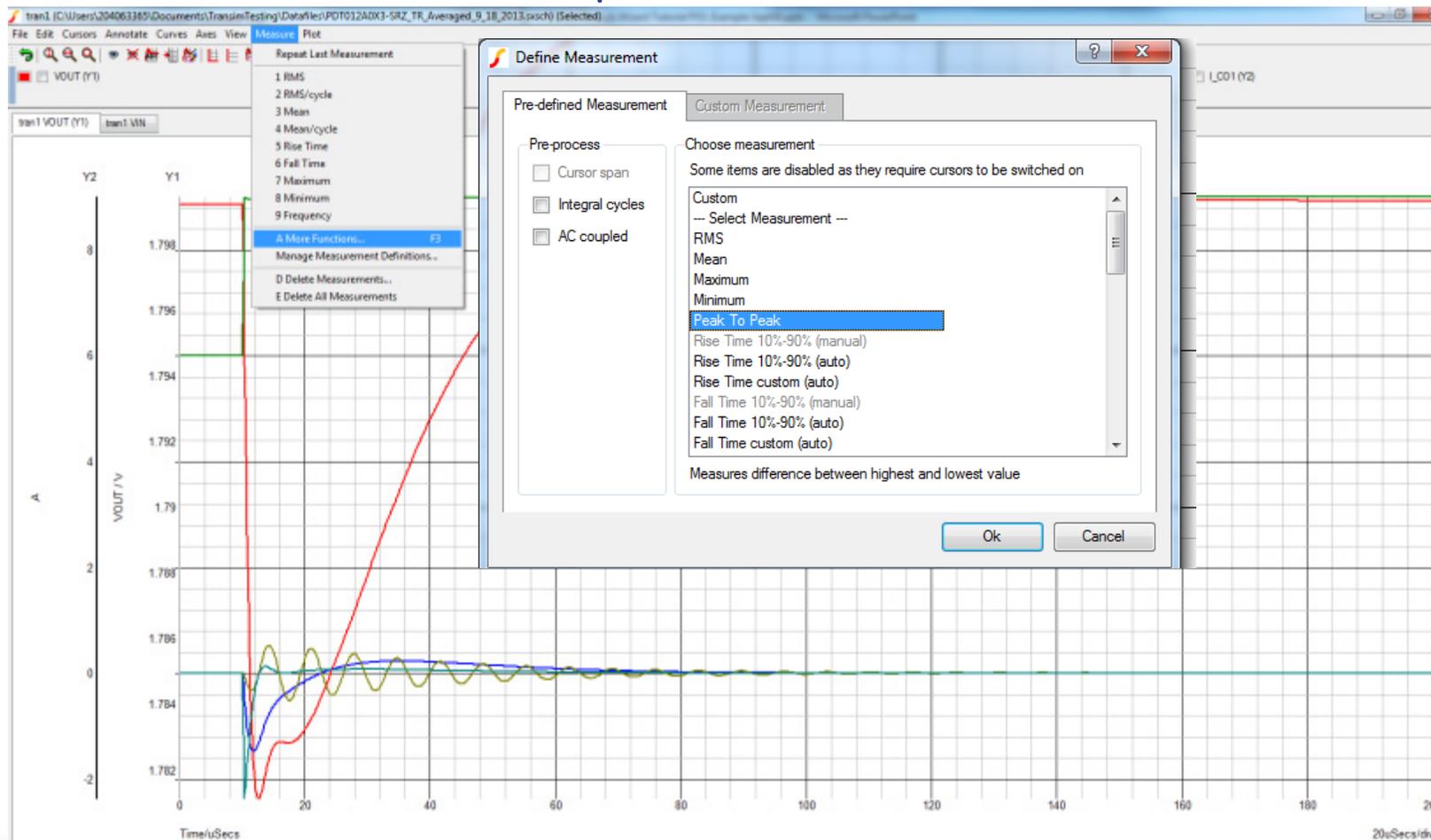
- Compare the results of the simulation with the online version. They should be the same



The values of crossover frequency and Phase Margin are close to the values of 46kHz and 95degrees from the online tool

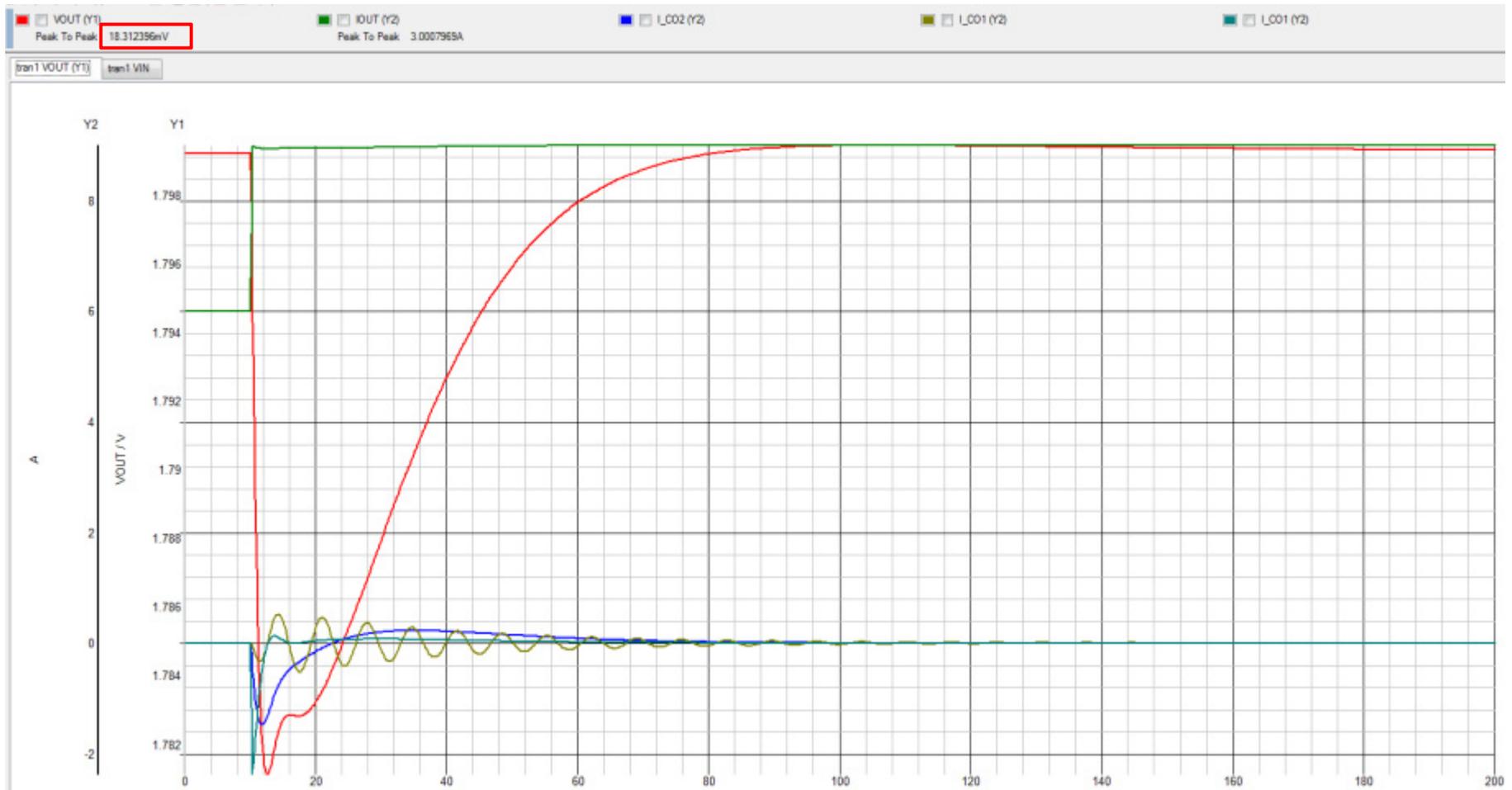
# Using the downloaded tool and files

- Close the existing simulation file. Go to the drop down menu under 'File' select 'Open Schematic' and open the xxxx\_TR\_Averaged\_xxx file. Run the simulation as before. In the Plot Window go to the Measure Tab and select More Functions from the drop down menu and then select Pk-Pk value



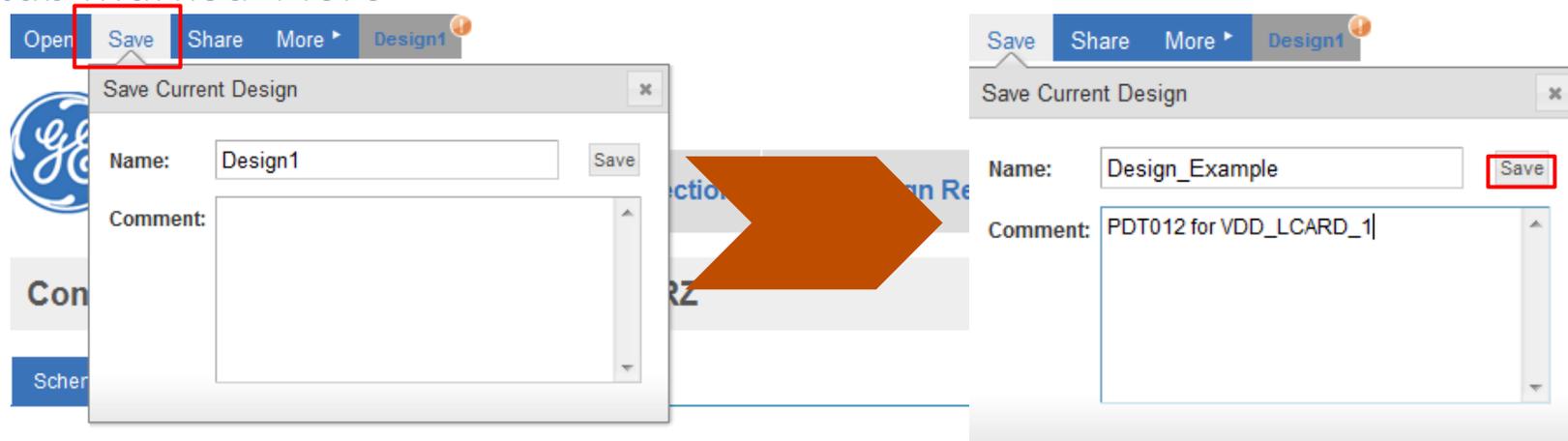
# Using the downloaded tool and files

- Compare the results of the simulation with the online version. They should be the same – 18mV



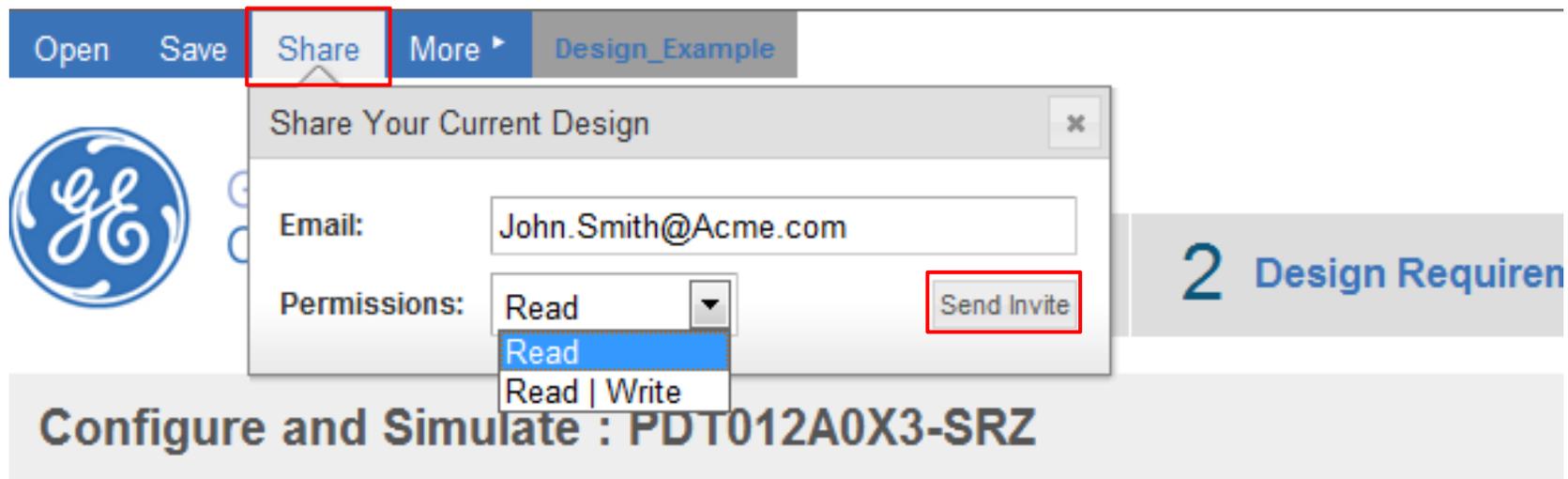
# Saving the Simulation

- Click on the Save Tab on the top left corner of the screen. In the pop-up window enter the name and comments, if any, for the design . Once the Save button is pressed a small Tab with the design name appears after the tab marked 'More'



# Sharing the Simulation

- Click on the Share Tab on the top left corner of the screen. In the pop-up window enter the destination email. The tool also allows the user to create a permission level of read or read/write for the recipient.



# Efficiency for specific operating conditions

- Click on the Efficiency Tab next to the Schematic and Download Tab on the screen. Overwrite the input voltage as 11V and the ambient temperature as 70°C. Then press the Calculate button for the tool to simulate the efficiency curve for the specified conditions

**GE Critical Power** **Power Module Wizard**

1 Part Selection   2 Design Requirements   **3 Analyze**   4 BOM   5 Summary   Help

**Configure and Simulate : PDT012A0X3-SRZ**

Schematic   Download   **Efficiency**

### Efficiency Estimation Tool

Vin	<input type="text" value="11"/>	V
Vout	<input type="text" value="1.8"/>	V
Ambient Temperature	<input type="text" value="70"/>	°C

Output Current (A)	Efficiency (%)
0	0
1	70
2	80
4	86
6	88
8	88
10	88
12	88

# BOM for final schematic

- Click on the BOM Tab on the top right corner of the screen next to the Analyze and Summary Tab on the screen. The tool generates a part list based on pricing from Arrow. Using the BOM Engine drop down menu on the left corner of the screen, a different distributor can be selected for pricing comparison

**GE Critical Power** **Power Module Wizard**

1 Part Selection
2 Design Requirements
3 Analyze
**4 BOM**
5 Summary
Help

BOM Engine: Arrow


**CHECKOUT** x  Boards
 Price Break

Ref	Qty	Find	Part Number	Manufacturer	Description	<b>Arrow</b> In Stock - Price
U1	1		<a href="#">PDT012A0X3-SRZ</a>	General Electric	CONVERTER DC/DC 5.5V 12A OUT	Yes - \$13.12
CI1	1		<a href="#">08056D226MAT2A</a>	AVX	Cap Ceramic 22uF 6.3VDC X5R 20% SMD 0805 Embossed T/R	No - Call
CO1	3		<a href="#">12106D476KAT2A</a>	AVX	Cap Ceramic 47uF 6.3VDC X5R 10% SMD 1210 Embossed T/R	No - Call
CO2	1		<a href="#">EEE-FK1A471GP</a>	Panasonic	Aluminum Electrolytic Capacitors - SMD Al Lytic Cap SMT FK Series 105C	Yes - \$0.3168
CTune	1		<a href="#">202S43W332KV4E</a>	Hammond Manufacturing	Cap Ceramic 0.0033uF 2000VDC X7R 10% SMD 1812 Embo	Yes - \$1.70
RTrim	1		<a href="#">1676153-2</a>	TE Connectivity	Res Thin Film 0805 10K Ohm 0.1% 1/10W ±10ppm/°C Molded SMD T/R	No - \$0.5276
RTune	1		<a href="#">2-1622820-8</a>	TE Connectivity	Res Thick Film 2512 270 Ohm 5% 1W ±200ppm/°C Molded SMD T/R	No - \$0.05

Please select a BOM engine from the list above.

# Summary Report – Part 1

- Click on the Summary Tab on the top right corner of the screen. The tool generates a report listing the operating conditions, BOM, Schematic, Waveforms for Stability Analysis, Switched Load Transient, Averaged Load Transient and Ripple Current and Voltage . The report can be printed or converted to pdf for storage

Summary Report : PDT012A0X3-SRZ



## Operating Conditions

Vin	11	V
Vout	1.8	V
Iout-max	9	A

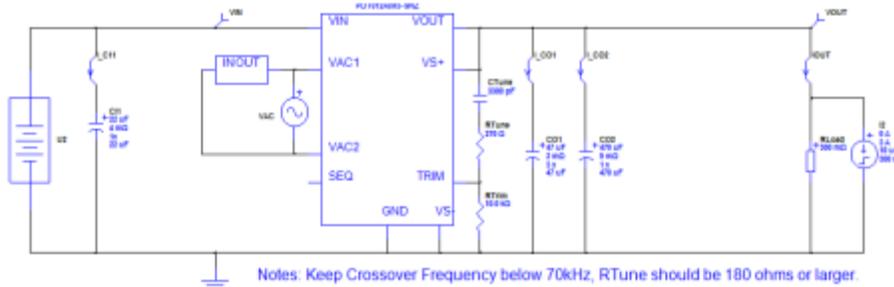
## Bill of Materials

Subcircuits	Quantity	Part Number
U1	1	PDT012A0X3-SRZ
U2	1	

Capacitors	Quantity	Capacitance
CO1	3	47uF
CO2	1	470uF
CTune	1	3300pF
CH1	1	22uF

Resistors	Quantity	Resistance
RTune	1	270Ω
RTrim	1	10.6kΩ

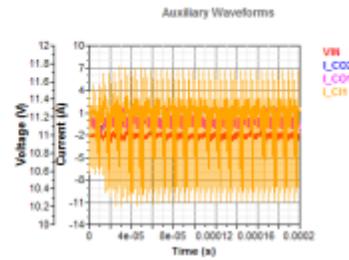
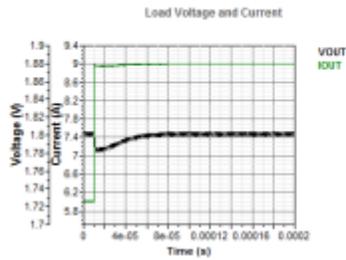
## Configured Schematic



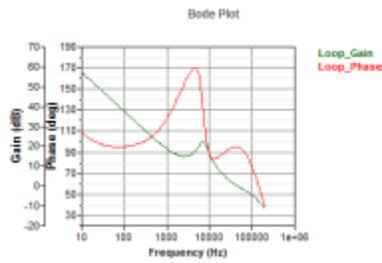
# Summary Report – Part 2

## Waveforms

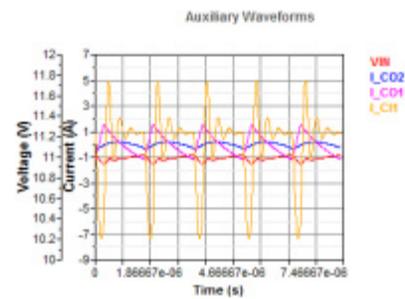
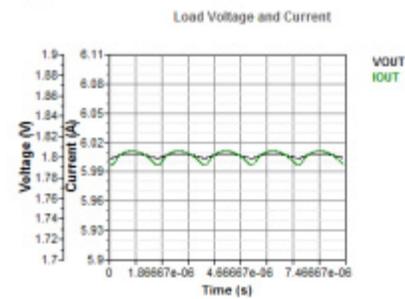
### Load Transient (Switched) Results



### Stability Analysis (Averaged) Results



### Ripple Current & Voltage Results



### Load Transient (Averaged) Results

