



# SwitcherPro™

*Analog eLab Design Center*

Presentation by Allen Wachter



# What is the SwitcherPro™ Design Tool?

- Easy to use simulator supporting TPS branded Switching DC/DC Controllers and Converters
- Selects actual external components from a library based on design parameter input
- Provides a schematic & BOM, performs stress analysis, plots efficiency, displays loop response, and recommends a layout
- Web based design tool with secure online design storage & sharing
- Downloadable version for portability



# Where is SwitcherPro?

Visit [power.ti.com](http://power.ti.com) and click on [Tools & Software](#) or [Analog eLAB](#)

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## Power Management

▪ [Cross Reference](#) ▪ [Application Notes](#) ▪ [Training](#) ▪ [Tools & Software](#) ▪ [Block Diagrams](#) ▪ [Reference Designs](#) ▪ [Analog eLAB](#)

Power Management IC solutions ranging from standard ICs to high performance plug-in, power brick, digital power and integrated power modules.

### Product Tree

**AC/DC and DC/DC Power Supplies**  
[MOSFET Drivers](#) (61)  
[PWM Power Supply Controllers](#) (215)  
[Power Factor Correction IC's](#) (49)  
[Power Supply Support](#)

### Device Quick Search

Input	Output 1	
*Nominal Vin (V)	Vout (V)	Iout (A)
<input type="text"/>	<input type="text"/>	<input type="text"/>



# Where is SwitcherPro?

Power Quick Search highlights supported devices

2 of 9 Results

[Show All Results](#)

[Go to Parametric Search](#)

## DC/DC Converters (Integrated Switch)

Part Number	Description	Design Software
TPS54610	Low Input Voltage 6A Synchronous Buck Converter with Adjustable Output Voltage	<a href="#">Design Now</a>
TPS54673	Low Input Voltage 6A Synchronous Buck Converter with Disabled Sinking During Start Up	

[Back to Top](#)

2 of 11 Results

[Show All Results](#)

[Go to Parametric Search](#)

## DC/DC Controllers (External Switch)

Part Number	Description	Design Software
TPS40009	Low Input (2.25V-5.5V) 600 kHz Frequency, Synchronous Buck Controller, Source/ Sink, Prebias Operati	<a href="#">Design Now</a>
TPS40041	Low Pin Count, Low V <sub>in</sub> Synchronous Buck DC/DC Controller	



# Where is SwitcherPro?

Parametric searches highlight supported devices

Customize Columns		Download Spreadsheet				
Part Number	Status	Design Software	Sub Family	Vin (min) (V)	Vin (max) (V)	Iout (max) (A)
▲ ▼	▲ ▼		▲ ▼	▲ ▼	▲ ▼	▲ ▼
TPS5420	ACTIVE	Design Now	Step-Down Regulators	5.5	36	2
Customize Columns		Download Spreadsheet				



# Login Screen

 <b>TEXAS INSTRUMENTS</b>		<b>Technology for Innovators™</b>		<b>search TI.com</b> <a href="#">all searches</a>		Enter Keywo
products	applications	design support	buy			

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## Account Login

your account gives you access to free samples ordering, newsletters, email alert management, training event signup, and more.

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I have a password:

Password

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I don't have a password:

**New account signup**

Country or Region of Residence

- Select a Country/Region -

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- [What's your privacy policy?](#)

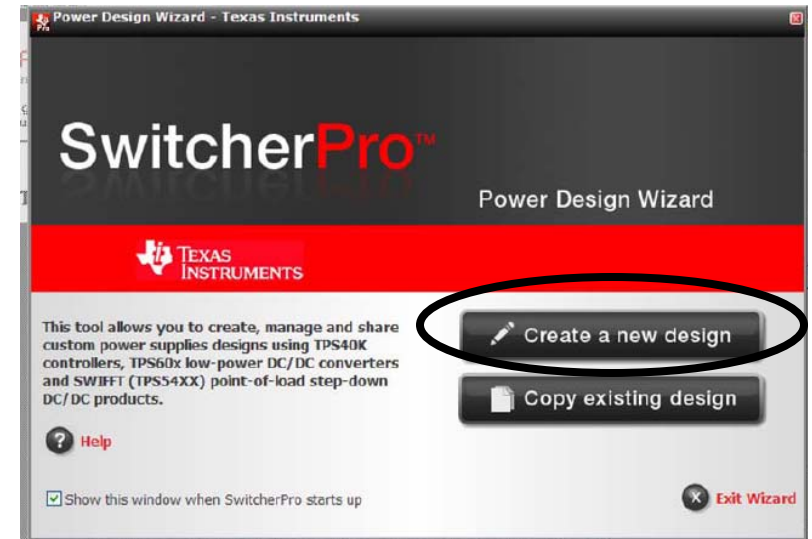


# Getting Started

After logging in the Design Wizard Screen will pop up  
Click [Create a New Design](#)

There are two ways to begin a simulation:

1. Select a Device: Brings up a list of devices supported by SwitcherPro in Alphanumeric order. Select the device you wish to use for your design.
2. Enter Specifications: Brings up boxes for you to enter design parameters.







# Getting Started

Either method above will open a window to enter design specifications.

1. Simple Input Form only needs  $V_{out}$ , Current, and  $V_{in}$  Range. Click [Find Devices](#) to display devices that meet the criteria
2. Advanced Input Form allows many more design parameters such as switching frequency, cap type, ripple voltages, phase and gain min to help narrow the search. Click [Find Devices](#) to display devices that meet the criteria.





# Getting Started

S/W displays all devices that meet your criteria. These may be converters or controllers. Again they are listed in Alphanumeric order and not by most relevant.

**Create New Design**

Simple Inputs   **Advanced Inputs**   Part Number   EVM Design

**Step 1.** Enter design parameters and click "Find Devices".

Design Name:

**Input**

Vin Min (V):  \*

Vin Max (V):  \*

**Output**

Vout (V):  \*

Iout Max (A):  \*

\* indicates required field

**Find Devices**

**Step 2.** Select a device and click "Design".

	Part Number	Description
<b>Design</b>	TPS40007	15A, 2.25V-5.5V in, 0.7V-4V out, Buck Controller, 10pin MSOP Controller, 10pin MSOP-PowerPAD
<b>Design</b>	TPS40009	15A, 2.25V-5.5V in, 0.7V-4V out, Buck Controller, Pre-Bias, 10 Controller, Pre-Bias, 10pin MSOP-PowerPAD
<b>Design</b>	TPS40021	20A, 2.25V-5.5V in, 0.7V-4V out, Buck Controller, 16 pin Controller, 16 pin PowerPAD
<b>Design</b>	TPS40040	15A, 2.25V-5.5V in, 0.6V-4.95V out, Buck Controller, 8 pin Controller, 8 pin PowerPAD
<b>Design</b>	TPS40041	15A, 2.25V-5.5V in, 0.6V-4.95V out, Buck Controller, 8 pin Controller, 8 pin PowerPAD
<b>Design</b>	TPS40042	15A, 3V-5.5V in, 0.5V-4.95V out, Buck Controller, 10 pin Controller, 10 pin PowerPAD
<b>Design</b>	TPS40190	10A, 4.5-15V Vin, 0.591-13.5 Vout, Sync Buck Controller, 10 Controller, 10-pin SON
<b>Design</b>	TPS40192	15A, 4.5-18V Vin, 0.591-15 Vout, Sync Buck Controller, 10-p Controller, 10-pin SON
<b>Design</b>	TPS40193	20A, 4.5-18V Vin, 0.591-15 Vout, Sync Buck Controller, 10-p Controller, 10-pin SON
<b>Design</b>	TPS40195	17A, 4.5V-20V in, 0.59V-17V out, Synchronous Buck Buck Controller, 16 pin PowerPAD
<b>Design</b>	TPS54550	6A, 4.5V-20V in, 0.9V-12V out, Buck Converter w/Integrated w/Integrated Upper MOSFET, 16pin HTSSOP
<b>Design</b>	TPS54610	6A, 3V-6V in, 0.9V-4.5V out, Buck Converter w/Integrated w/Integrated MOSFETs, 28pin HTSSOP
<b>Design</b>	TPS54615	6A, 3V-6V in, 2.5V out, Buck Converter w/Integrated w/Integrated MOSFETs, 28pin HTSSOP

Having trouble finding a device? More devices are available using the [Power Quick Search Tool](#)



# Output Views



## Schematic

- Any external component highlighted in red may be modified
- Mouse-over displays component information

## Analysis

- View calculated versus input parameters
- Export to Word or Excel file

## Stress

- Shows worse case power dissipation for the components

## Efficiency

- Shows nominal efficiencies using RMS currents

## Loop Response (Bode Plot)

- Displays cross-over frequency and gain/phase margin
- Scale up or down to improve the view

## Bill of Materials

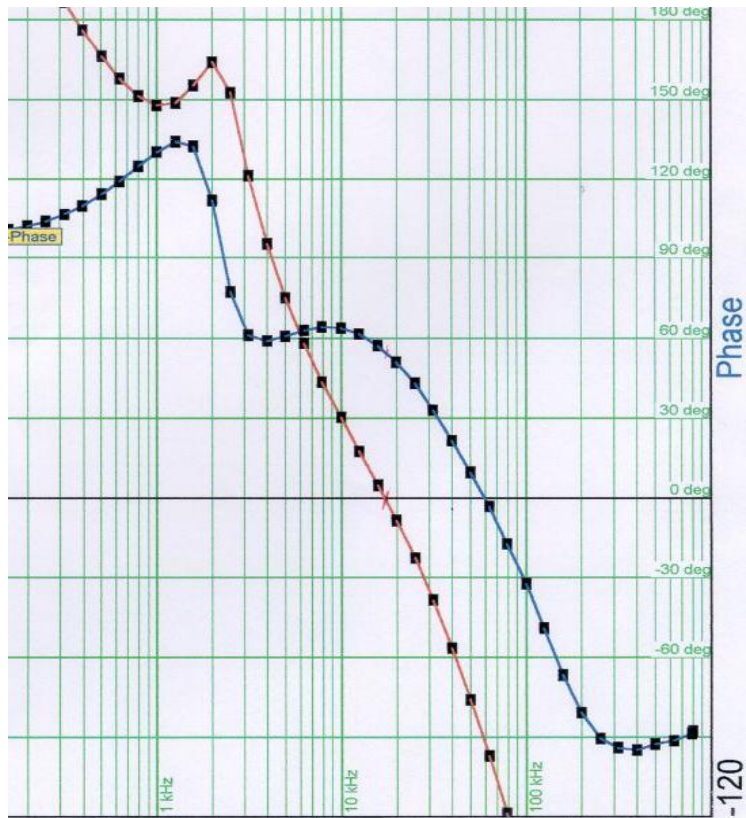
- Export to Excel file

## Layout

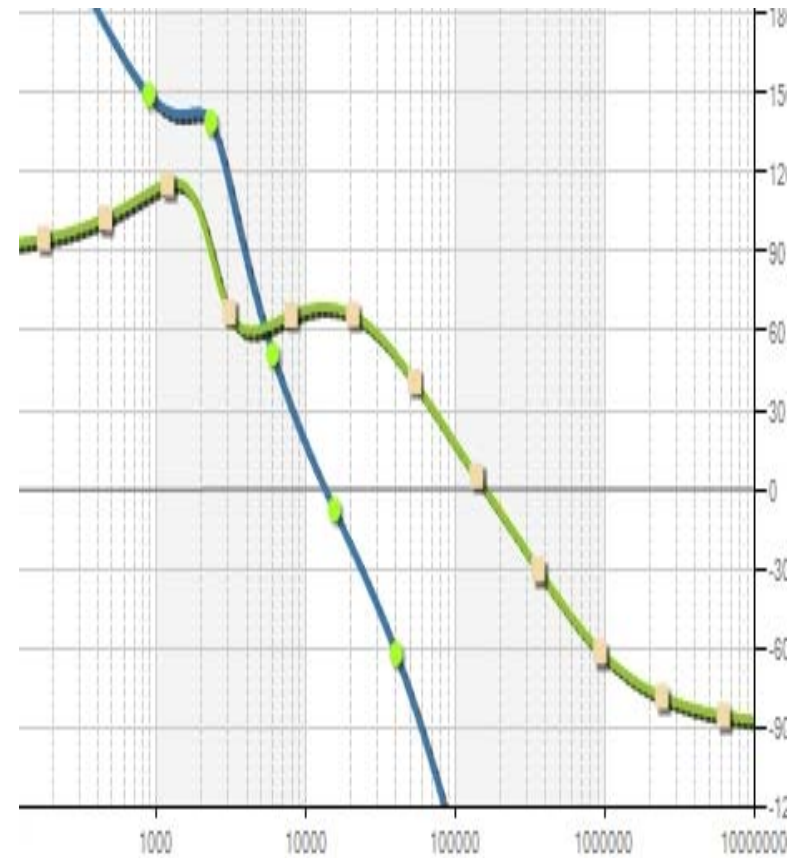
- Shows recommended top side layout and text guidelines



# Lab Comparisons



Actual from Venable



Output from SwitcherPro



# Lab Comparisons

## Efficiency at 10Vin / 5Vout

	<b>Tool</b>	<b>Lab</b>
$\eta$ @ 2-A	90.7%	92.7%
$\eta$ @ 1-A	92.3%	94.1%

- A SwitcherPro simulation is available for many Evaluation Modules
- SwitcherPro output views are checked by TI against real world measurements before new TI devices are added to the software tool
- SwitcherPro uses a conservative approach for calculations, such as  $R_{ds(on)}$ . Expect some variance in external component parameters



# Changing Components

## Selecting another component:

- Use the filter engines with text to search for a suitable replacement

**Inductor Properties**

**Current Inductor**

Name:

Part Number: VLF12060T-150M5R0

Manufacturer: TDK

Locked: ☐

Value: 15uH

DCR: 26mΩ

SAT Current Rating: 5A

RMS Current Rating: 5A

Package Name: Standard

Package Area: 140mm<sup>2</sup>

**Available Inductors**


	Part Number	Manufacturer	Value(μH)	DCR(Ω)	SAT Current Rating(A)	RMS Current Rating(A)
Select	JHLP-2525CZ-01 0.1uH	Vishay	0.10	0.0017	60.0000	32.5
Select	744 324 015*	Würth Elektronik eSos	0.15	0.0007	38.0000	24.0
Select	JHLP-2525CZ-01 0.2uH	Vishay	0.20	0.0030	52.0000	26.0
Select	744 312 025	Würth Elektronik eSos	0.22	0.0021	16.0000	11.0
Select	744 300 022*	Würth Elektronik eSos	0.22	0.0006	18.0000	15.0
Select	JHLP-5050FD-01 0.22uH	Vishay	0.22	0.0007	112.0000	53.0
Select	DO3316P-331HC	Coilcraft	0.33	0.0020	20.0000	16.0
Select	744 324 033*	Würth Elektronik eSos	0.33	0.0014	30.0000	20.0
Select	FP3-R47	Coiltronics	0.47	0.0037	11.6000	10.9
Select	744 362 047*	Würth Elektronik eSos	0.47	0.0023	30.0000	16.5



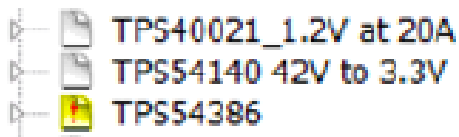


# Error Messages

SwitcherPro recognizes problems with a design and displays an error message.

 Duty cycle is too low for the device in this situation. Calculated on time is below the 'Minimum Controllable On Time' of the device! Use the analysis tab to view the calculated on time. This device has a 'Minimum Controllable On Time' of 80ns.

SwitcherPro recognizes problems when a poor choice for a substitute component is made, and displays a caution or an error message that will force you to choose a correct component



An error flag will be displayed if there are problems with the design. Click the error flag next to the design name to display the error messages.



# What-If Analysis

To tailor the gain and phase margin, perform a What-If analysis

- View your changes as they are made
- Modify compensation components, frequencies, & other parameters

Compensation

Power Stage

Conditions

○ Components

Edit resistor and capacitor values

Name	Value	Units
C7	100	pF
C6	10000	pF
C8	1000	pF
R3	4220	$\Omega$
R1	20000	$\Omega$
R5	2610	$\Omega$

Calculate

● Poles And Zero Frequencies

Edit pole and zero frequencies

Name	Value	Units
First Zero	7039	Hz
Second Zero	3771	Hz
First Pole	60979	Hz
Second Pole	380916	Hz
Int Pole Crossover	796	Hz

Calculate

☐ Lock Components

- lock in component values so the software will not overwrite values on any design changes you make.

Save Changes





# Help Using SwitcherPro

- Video support available in SwitcherPro tool folder

**Features**

- Create new designs with parts included
- Calculate efficiency
- Calculate loop responses
- View stress information on all key parts in the design
- Customize designs by changing part labels, changing parts, and changing outputs
- Change multiple parameters to model all types of what/if cases
- Get a simple schematic for your design
- Send designs to others on the system with your comments attached

**Support Software**

**Video for Web Part Interface in SwitcherPro** (slac127.zip, 7934 KB)  
18 Jan 2007 [zip](#)

**Video for The Design Manager in SwitcherPro** (slac126.zip, 23505 KB)  
18 Jan 2007 [zip](#)

**Video for Creating Designs in SwitcherPro** (slac125.zip, 12934 KB)  
18 Jan 2007 [zip](#)

**Video for Changing/Filtering Parts in SwitcherPro** (slac124.zip, 21911 KB)  
18 Jan 2007 [zip](#)

**Related Products**



# Products Currently Supported

**As of Today:**

**82 Power Devices**

**21 EVMs**

**Ciclon Power MOSFETs**

- More devices continue to be added SwitcherPro
- SWIFT, TPS40K, and TPS62K devices are supported
- Online and Downloadable Versions – Your choice



# Design Management

## **Design is automatically saved when updated**

- All designs kept in My Designs folder
- Designs can be renamed, cloned, deleted, or sent to another user

## **Transfer design to another user (Online Only)**

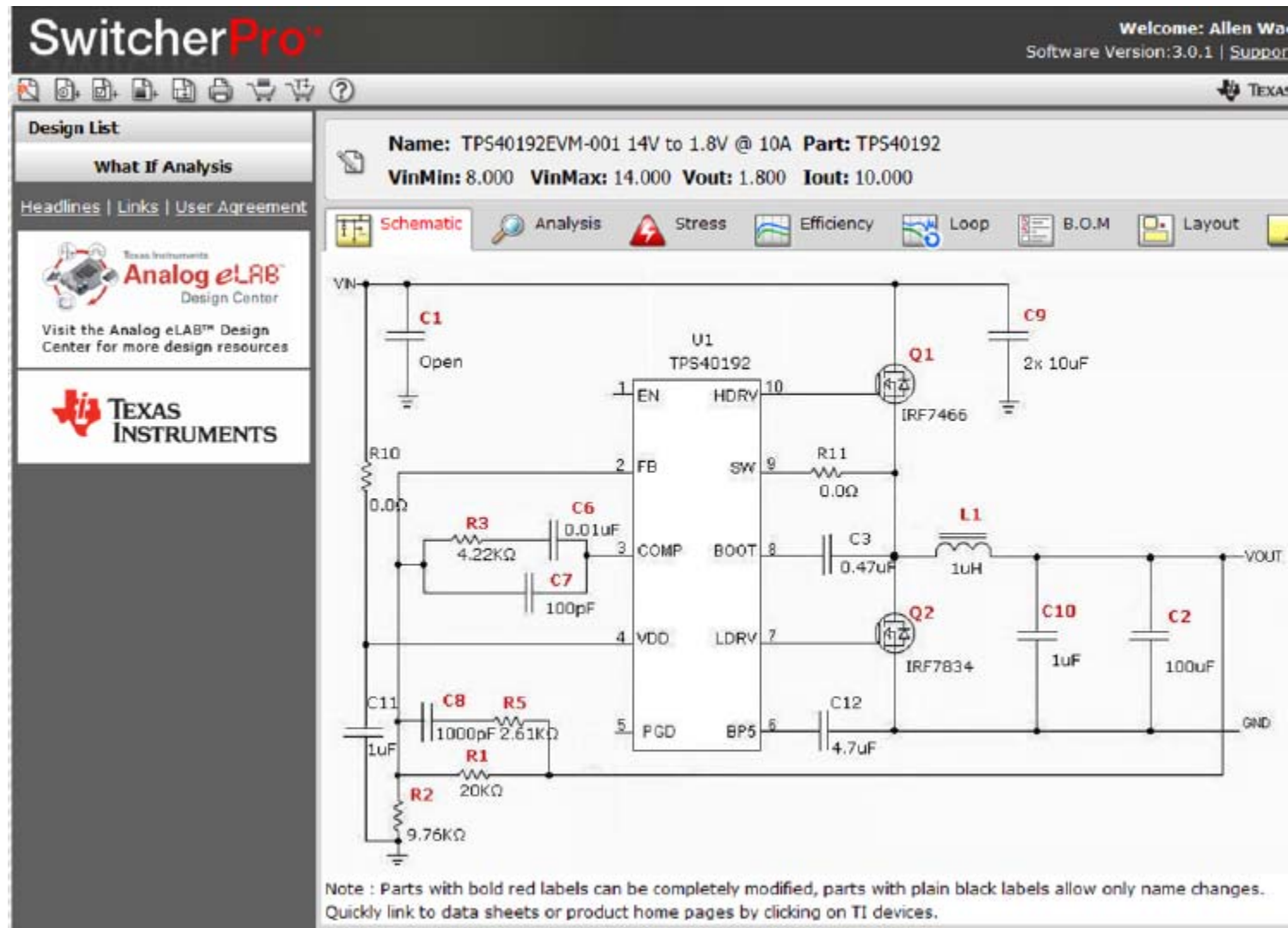
- Right-click on the design to send and select [Send Copy To...](#) then enter recipient's email address
- Design is copied onto another registered user's inbox, not emailed
- Send design to a coworker or one of our Applications Engineers

## **3DES encryption is employed**

- https web server encryption within my.ti.com
- Traffic between web server and SQL server is encrypted
- 100% stored procedure prevents SQL injection attack
- Viewstate cache is stored on server, not on the client machine



# Simple Interface Screen





# Summary

- One on-line tool supports TPS DC/DC switching regulators
- Automatically designs the power supply with minimal input from the user
- Chooses real world external components from database
- Modify the external components to better suit design goals
- Compare several designs on one screen to see the differences
- Easily save and transfer design files securely



# Let's Take it for a Spin

## A Few Demos...



**Thank You!**

**Questions?**