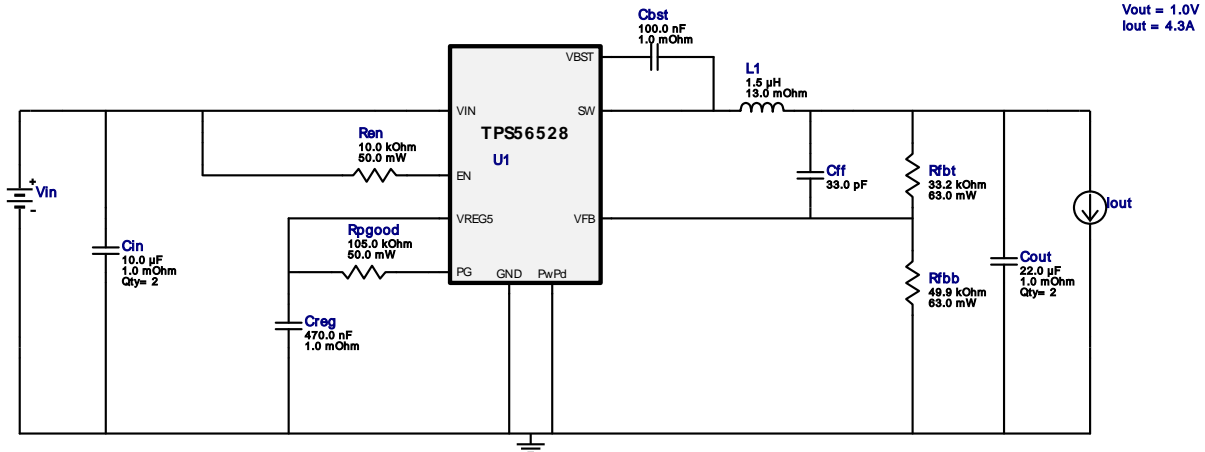

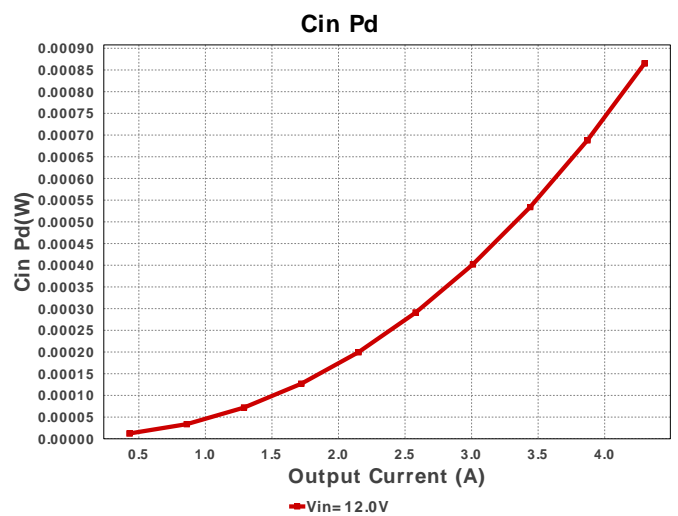
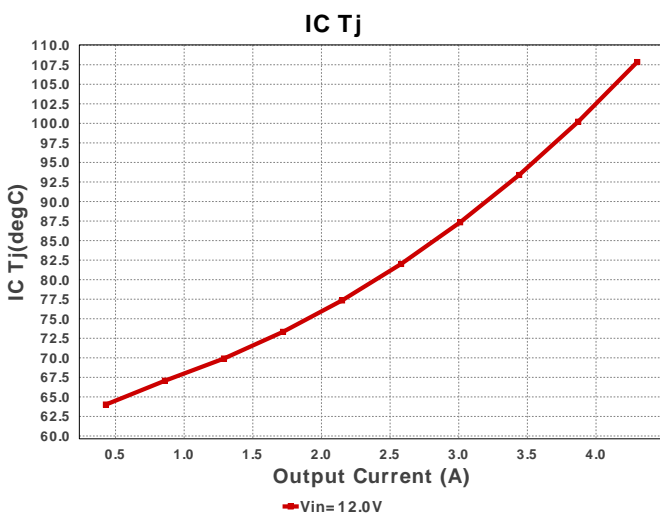
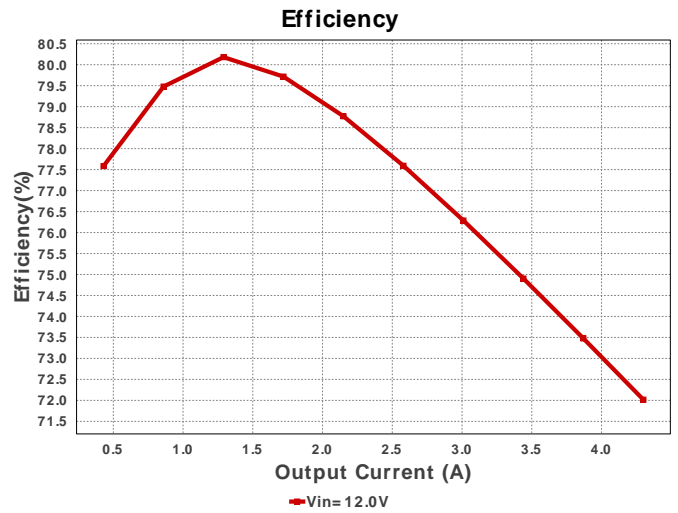
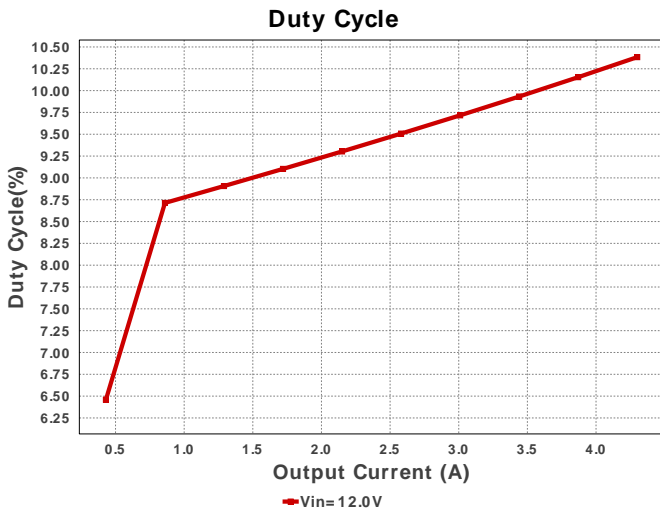
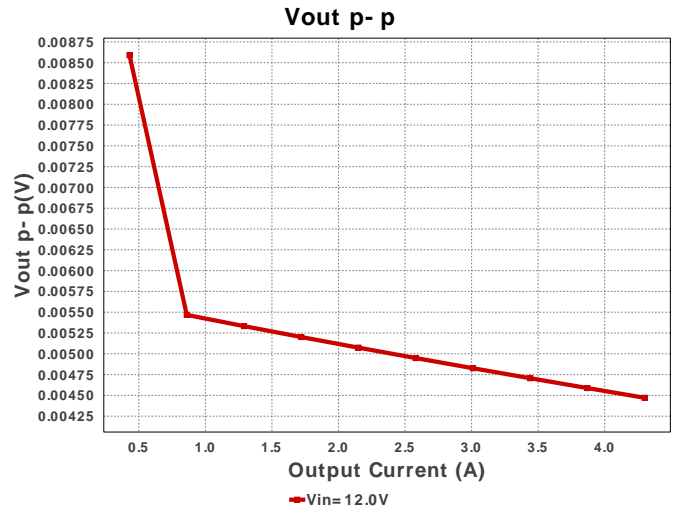
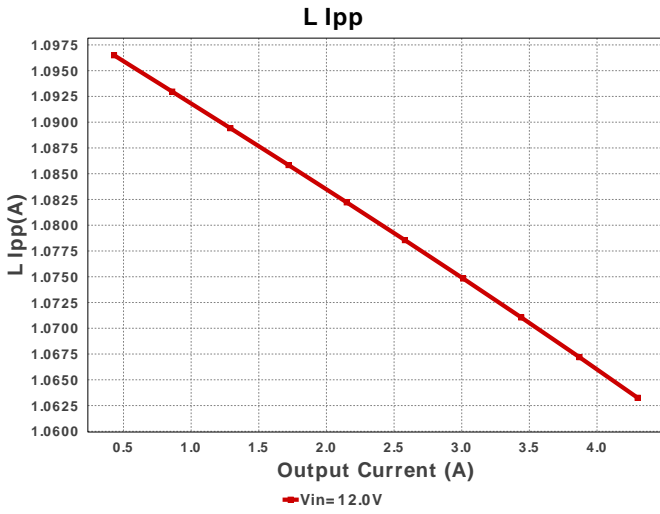


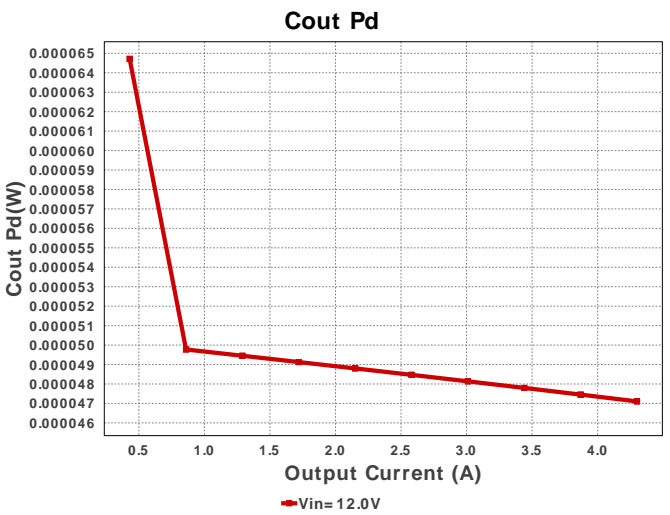
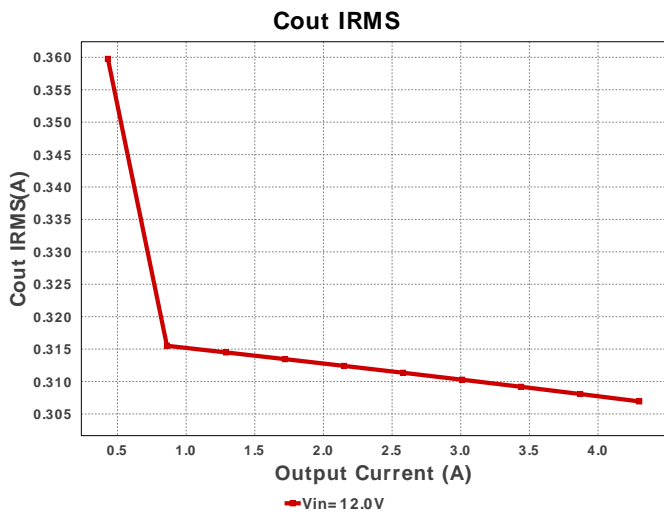
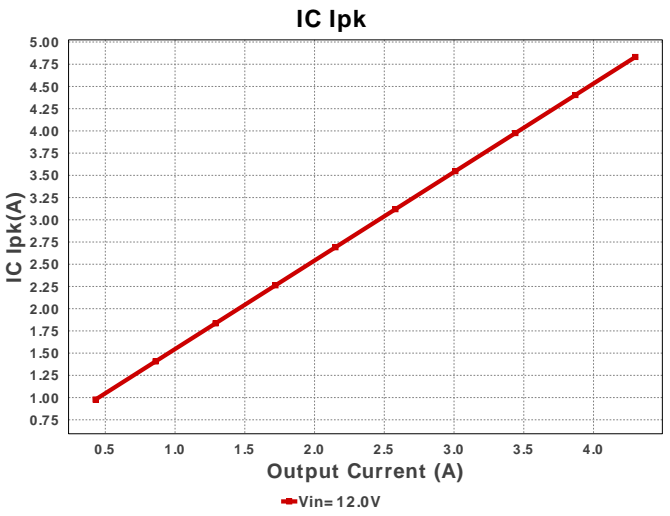
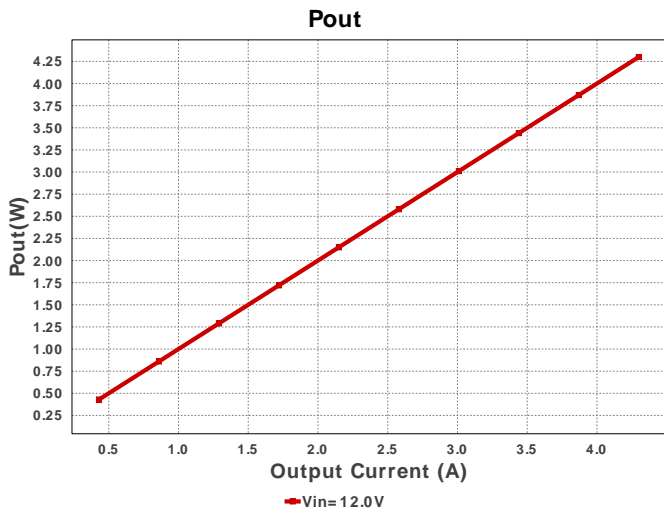
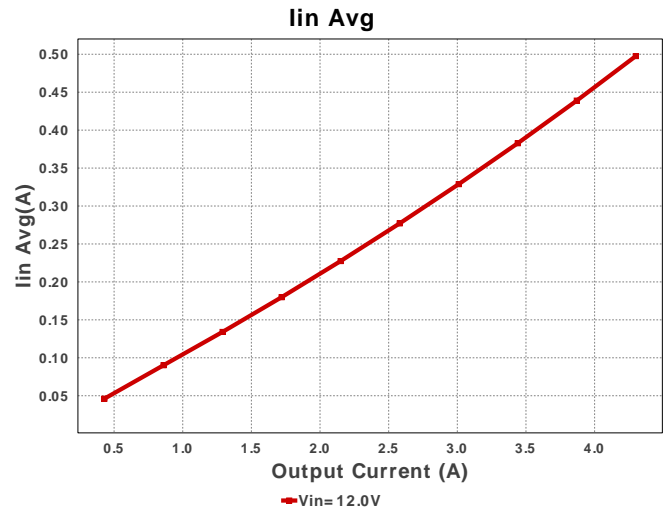
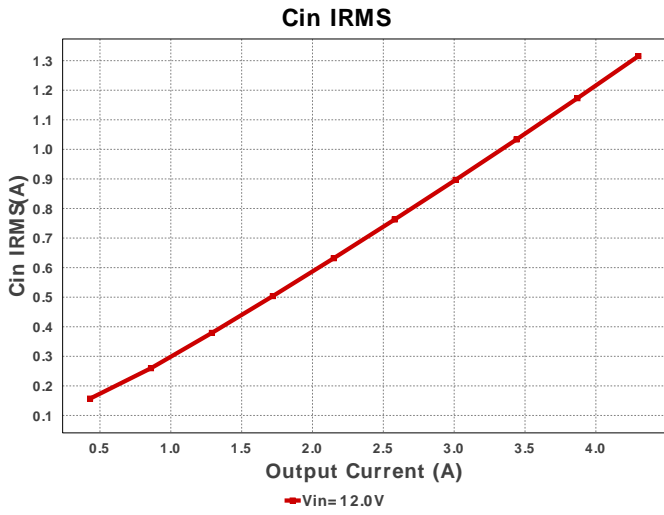
**WEBENCH® Design Report**

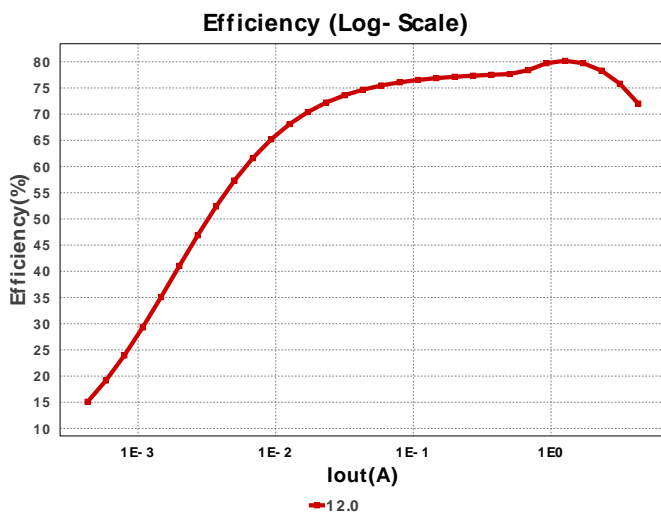
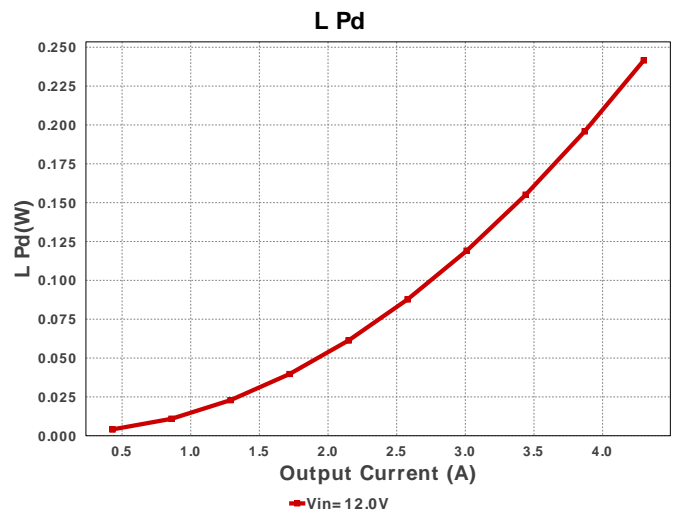
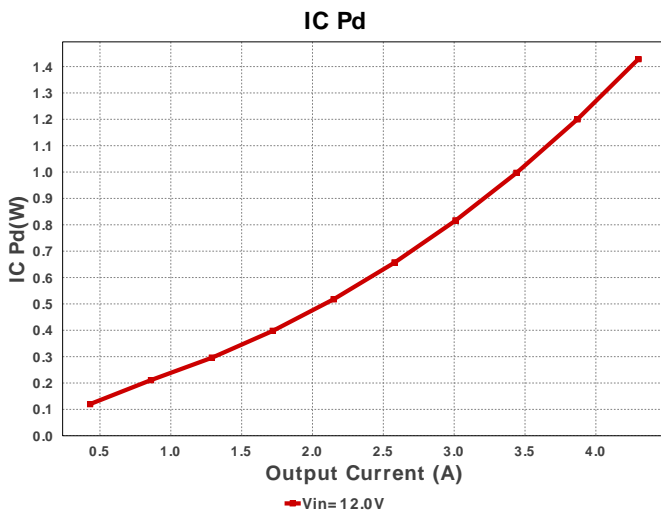
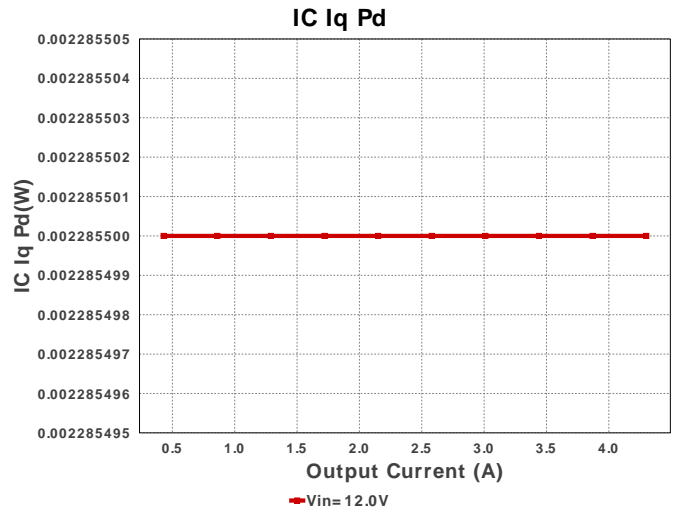
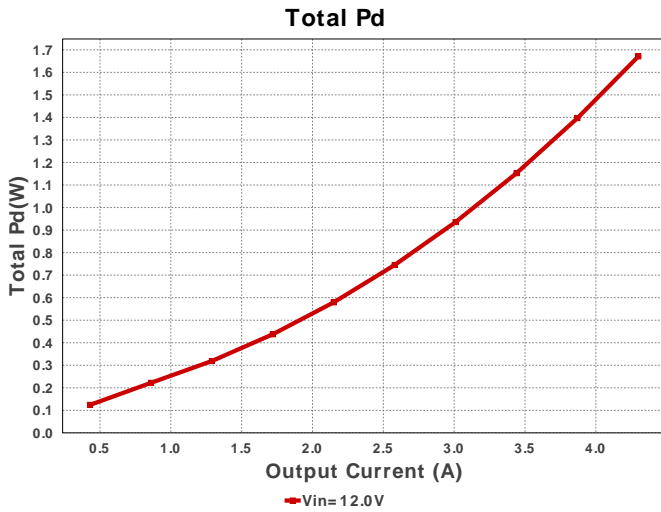
 Design : 8 TPS56528DDAR  
 TPS56528DDAR 12V-12V to 1.00V @ 4.3A

**Electrical BOM**

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	MuRata	GRM155R71A104KA01D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm <sup>2</sup>
Cff	TDK	CGA1A2C0G1E330J030BA Series= C0G/NP0	Cap= 33.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm <sup>2</sup>
Cin	MuRata	GRM32ER71J106KA12L Series= X7R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 63.0 V IRMS= 6.0 A	2	\$0.30	1210_280 15 mm <sup>2</sup>
Cout	TDK	C2012X7S1A226M125AC Series= X7S	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	2	\$0.29	0805 7 mm <sup>2</sup>
Creg	Taiyo Yuden	TMK212BJ474KD-T Series= X5R	Cap= 470.0 nF ESR= 1.0 mOhm VDC= 20.0 V IRMS= 0.0 A	1	\$0.02	0805 7 mm <sup>2</sup>
L1	TDK	VLP8040T-1R5N	L= 1.5 uH 13.0 mOhm	1	\$0.22	VLP8040 113 mm <sup>2</sup>
Ren	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	0201 2 mm <sup>2</sup>
Rfbb	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
Rfbt	Vishay-Dale	CRCW040233K2FKED Series= CRCW..e3	Res= 33.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
Rpgood	Yageo	RC0201FR-07105KL Series= ?	Res= 105.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	0201 2 mm <sup>2</sup>

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
U1	Texas Instruments	TPS56528DDAR	Switcher	1	\$0.38	 R-PDSO-G8 55 mm <sup>2</sup>







### Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.315 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	865.16 $\mu$ W	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	306.935 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	47.105 $\mu$ W	Capacitor	Output capacitor power dissipation
5.	IC Ipk	4.832 A	IC	Peak switch current in IC
6.	IC Iq Pd	2.286 mW	IC	IC Iq Pd
7.	IC Pd	1.428 W	IC	IC power dissipation
8.	IC Tj	107.848 degC	IC	IC junction temperature
9.	ICThetaJA Effective	33.5 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
10.	Iin Avg	497.57 mA	IC	Average input current
11.	L Ipp	1.063 A	Inductor	Peak-to-peak inductor ripple current

#	Name	Value	Category	Description
12.	L Pd	241.59 mW	Inductor	Inductor power dissipation
13.	Cin Pd	865.16 $\mu$ W	Power	Input capacitor power dissipation
14.	Cout Pd	47.105 $\mu$ W	Power	Output capacitor power dissipation
15.	IC Pd	1.428 W	Power	IC power dissipation
16.	L Pd	241.59 mW	Power	Inductor power dissipation
17.	Total Pd	1.671 W	Power	Total Power Dissipation
18.	BOM Count	13	System Information	Total Design BOM count
19.	Duty Cycle	10.383 %	System Information	Duty cycle
20.	Efficiency	72.017 %	System Information	Steady state efficiency
21.	FootPrint	234.0 mm <sup>2</sup>	System Information	Total Foot Print Area of BOM components
22.	Frequency	692.222 kHz	System Information	Switching frequency
23.	Iout	4.3 A	System Information	Iout operating point
24.	Mode	CCM	System Information	Conduction Mode
25.	Pout	4.3 W	System Information	Total output power
26.	Total BOM	\$1.86	System Information	Total BOM Cost
27.	Vin	12.0 V	System Information	Vin operating point
28.	Vout	1.0 V	System Information	Operational Output Voltage
29.	Vout Actual	999.198 mV	System Information	Vout Actual calculated based on selected voltage divider resistors
30.	Vout Tolerance	3.159 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
31.	Vout p-p	4.471 mV	System Information	Peak-to-peak output ripple voltage

## Design Inputs

Name	Value	Description
Iout	4.3	Maximum Output Current
VinMax	12.0	Maximum input voltage
VinMin	12.0	Minimum input voltage
Vout	1.0	Output Voltage
base_pn	TPS56528	Base Product Number
source	DC	Input Source Type
Ta	60.0	Ambient temperature

## WEBENCH® Assembly

### Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of  $C_{in}$  and  $C_{out}$ , and the inductance and DC resistance of  $L1$  before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

### Soldering Component to Board

If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab down to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

### Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 12.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to  $V_{in}$  and GND. Connect a digital volt meter and a load if needed to set the minimum load of the design from  $V_{out}$  and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

### Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between  $V_{in}$  and GND, a load is connected between  $V_{out}$  and GND and a current meter is connected in series between  $V_{out}$  and the load. The load must be able to handle at least rated output power + 50% ( 7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



# WEBENCH® Electrical Simulation Report

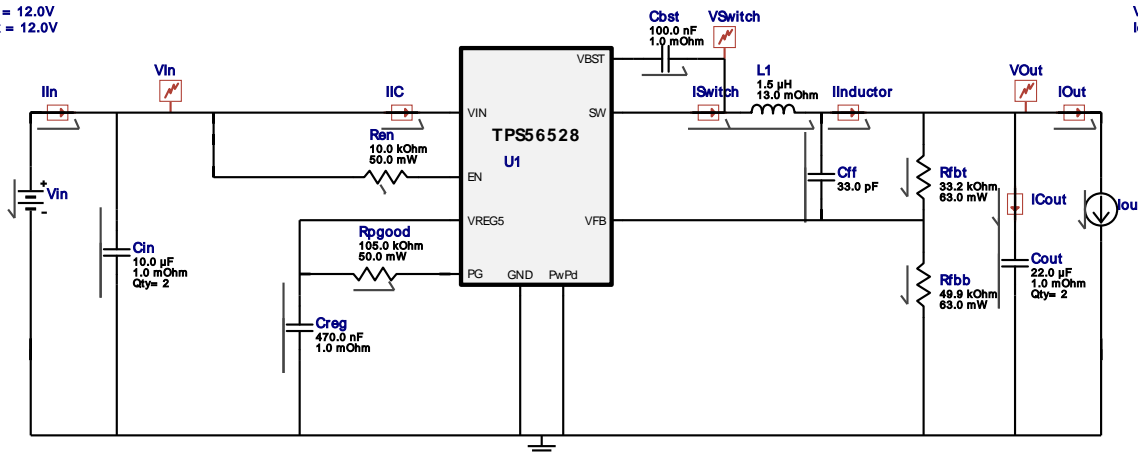
Design Id = 8

sim\_id = 1

Simulation Type = Steady State

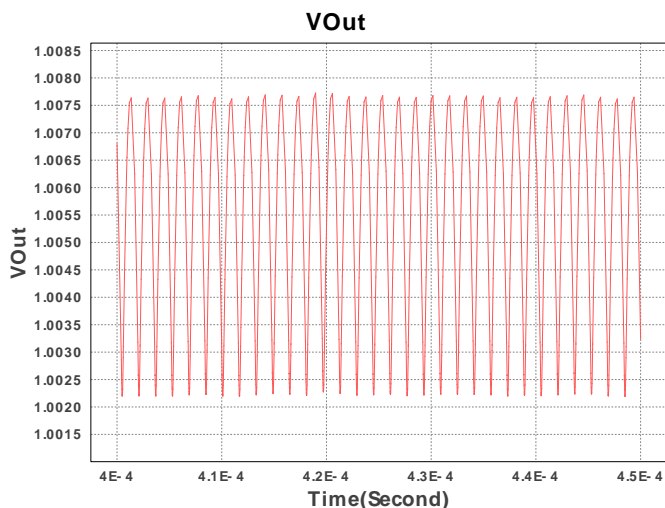
VinMin = 12.0V  
VinMax = 12.0V

Vout = 1.0V  
Iout = 4.3A



## Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cff	IC	no description	0.6
2.	Cbst	IC	no description	5
3.	Creg	IC	no description	0.6
4.	L1	IC	Initial Current	4.3 A
5.	Iout	I	Output Current	4.3 A



## Design Assistance

- Master key : 41E8874367B5AA92[v1]
- TPS56528 Product Folder : <http://www.ti.com/product/TPS56528> : contains the data sheet and other resources.

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