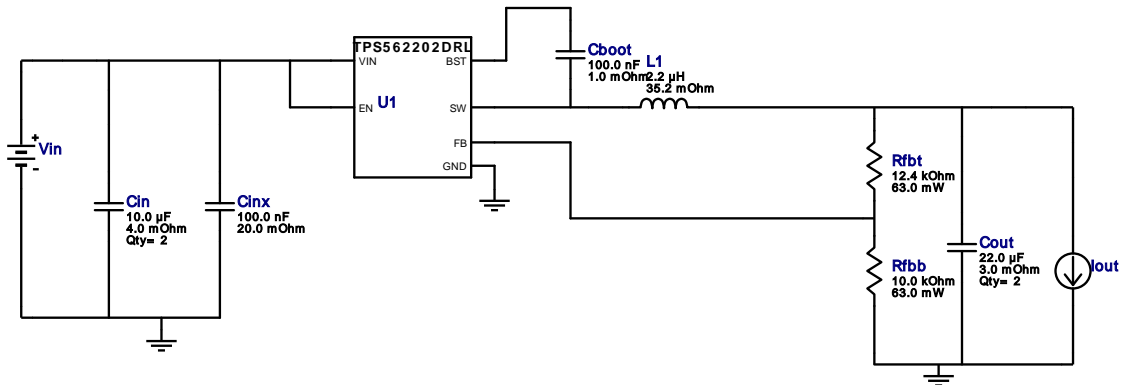


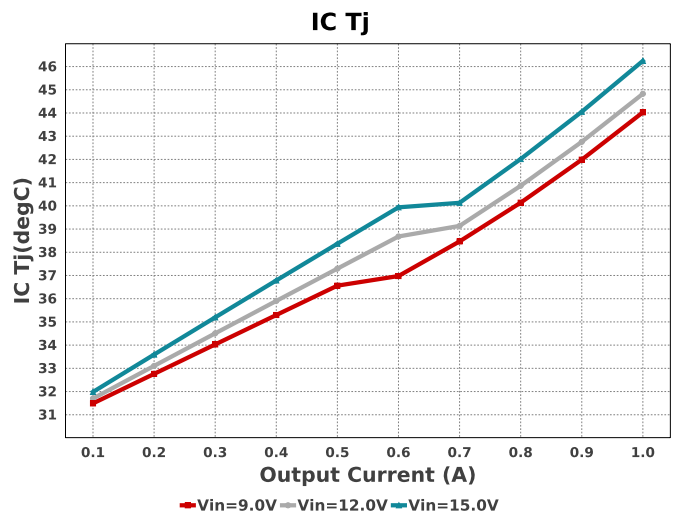
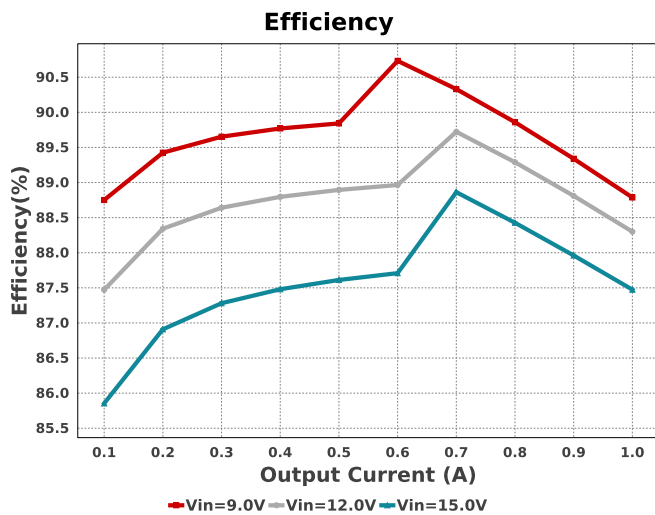
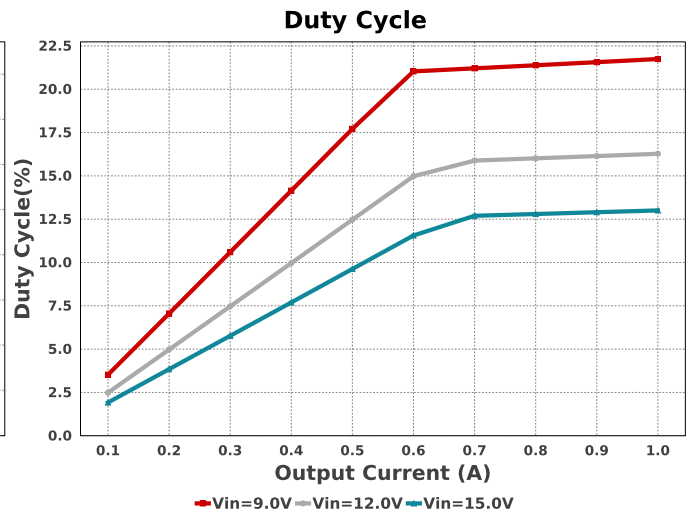
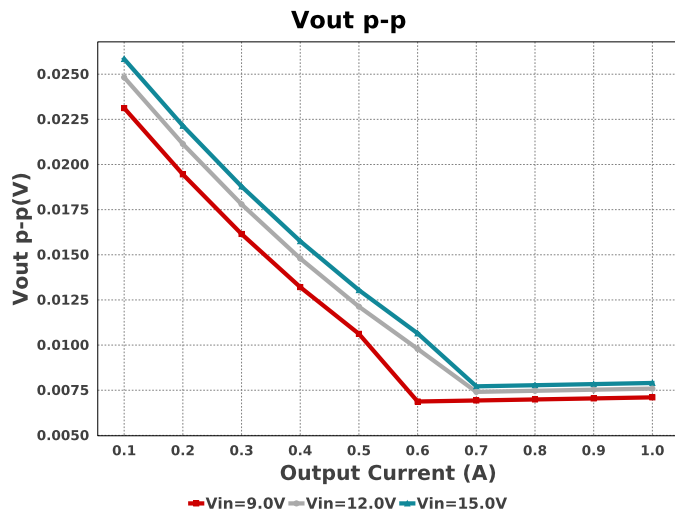
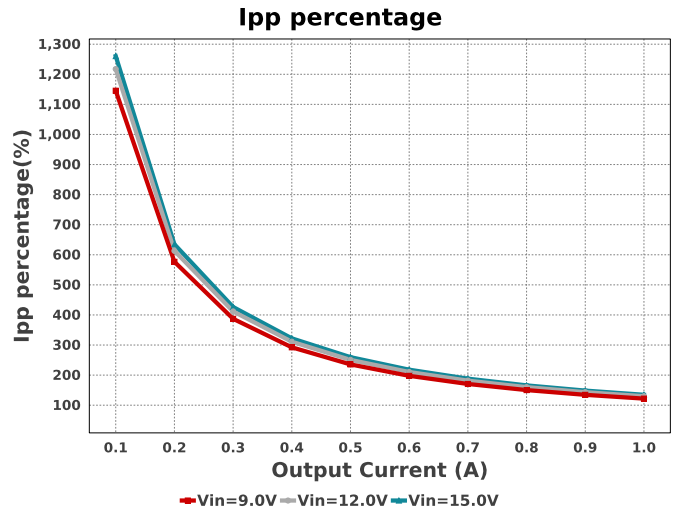
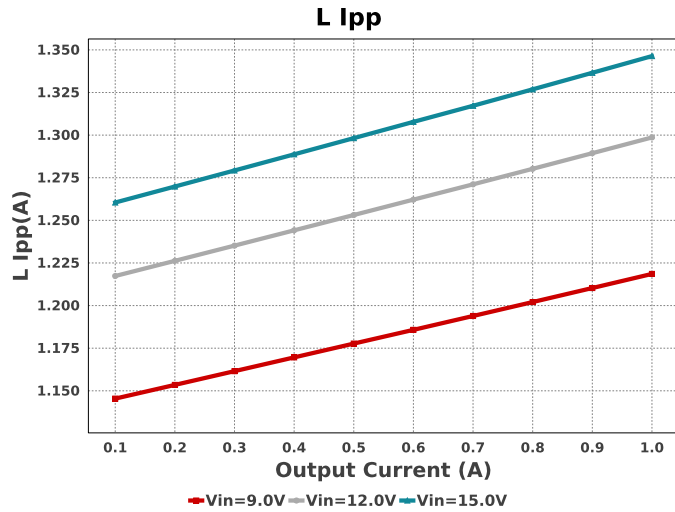
## WEBENCH® Design Report

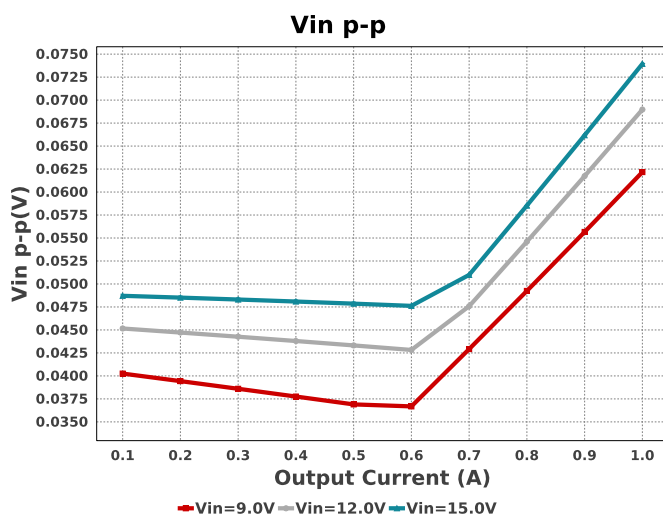
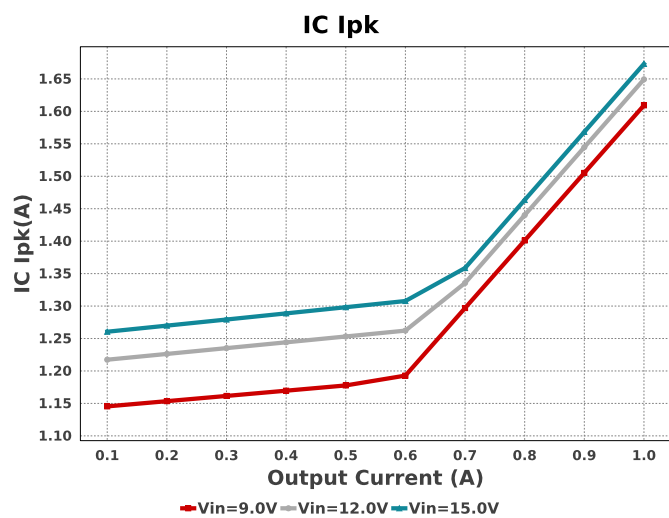
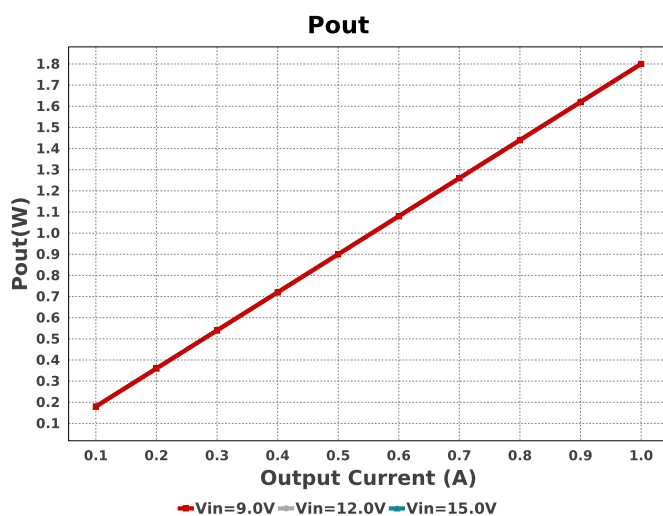
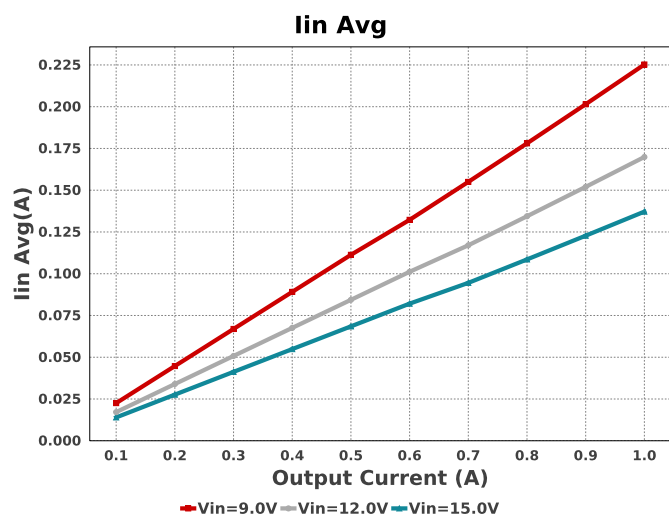
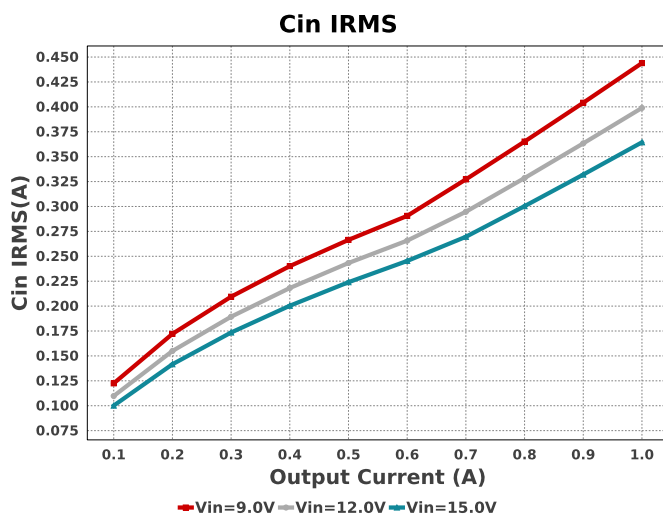
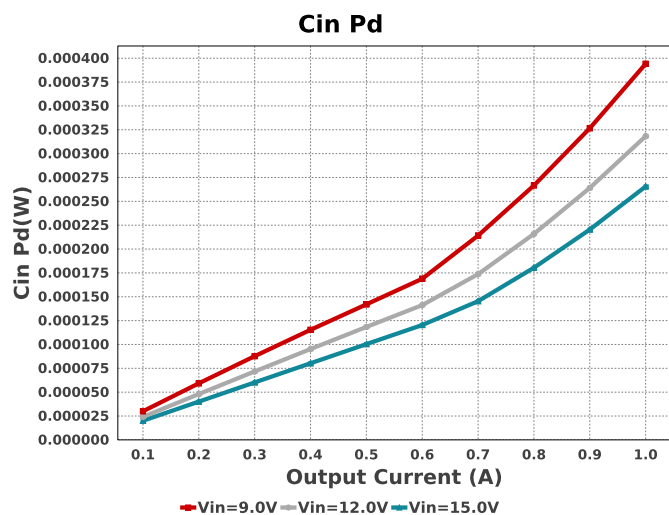
Design : 16 TPS562202DRLR  
TPS562202DRLR 9V-15V to 1.80V @ 1A

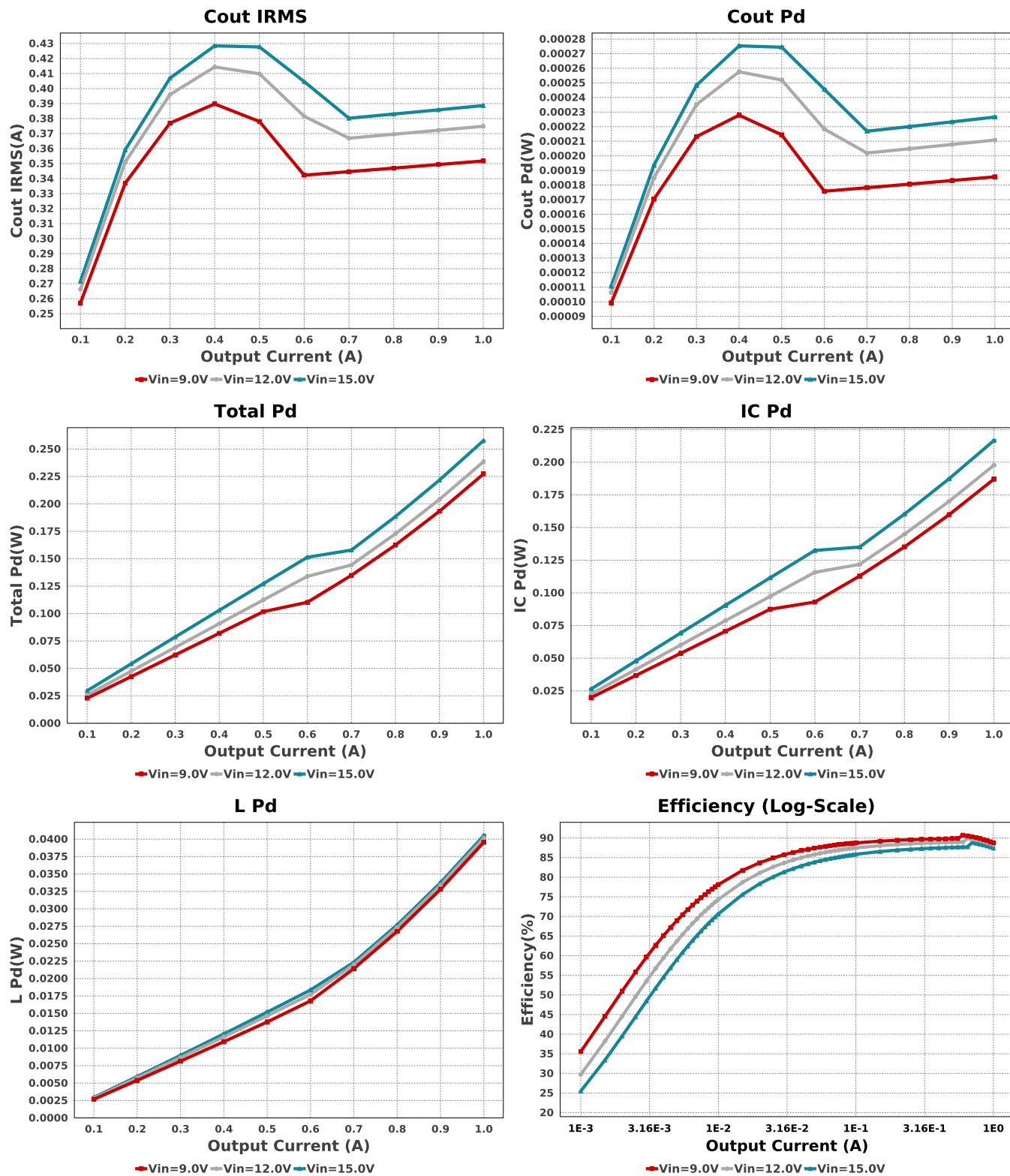


## Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cboot	MuRata	GRM155R71C104KA88D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm <sup>2</sup>
Cin	MuRata	GRM21BR61E106MA73L Series= X5R	Cap= 10.0 uF ESR= 4.0 mOhm VDC= 25.0 V IRMS= 2.8 A	2	\$0.04	0805 7 mm <sup>2</sup>
Cinx	MuRata	GRM188R71H104KA93D Series= X7R	Cap= 100.0 nF ESR= 20.0 mOhm VDC= 50.0 V IRMS= 3.8 A	1	\$0.02	0603 5 mm <sup>2</sup>
Cout	MuRata	GRM21BR61A226ME44L Series= X5R	Cap= 22.0 uF ESR= 3.0 mOhm VDC= 10.0 V IRMS= 3.84 A	2	\$0.09	0805 7 mm <sup>2</sup>
L1	Coilcraft	XAL4020-222MEB	L= 2.2 uH 35.2 mOhm	1	\$0.60	XAL4020 28 mm <sup>2</sup>
Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW...e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
Rfbb	Vishay-Dale	CRCW040212K4FKED Series= CRCW...e3	Res= 12.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
U1	Texas Instruments	TPS562202DRLR	Switcher	1	\$0.07	DRL0006A 7 mm <sup>2</sup>







## Operating Values

#	Name	Value	Category	Description
1.	BOM Count	10		Total Design BOM count
2.	Total BOM	\$0.98		Total BOM Cost
3.	Cin IRMS	364.402 mA	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	265.58 $\mu$ W	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	388.66 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	226.58 $\mu$ W	Capacitor	Output capacitor power dissipation
7.	IC Ipk	1.673 A	IC	Peak switch current in IC
8.	IC Pd	216.6 mW	IC	IC power dissipation
9.	IC Tj	46.245 degC	IC	IC junction temperature
10.	IC Tolerance	16.0 mV	IC	IC Feedback Tolerance
11.	ICThetaJA Effective	75.0 degC/W	IC	IC junction-to-ambient thermal resistance with TI EVM

#	Name	Value	Category	Description
12.	I <sub>in</sub> Avg	137.18 mA	IC	Average input current
13.	I <sub>pp</sub> percentage	134.636 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
14.	L I <sub>pp</sub>	1.346 A	Inductor	Peak-to-peak inductor ripple current
15.	L P <sub>d</sub>	40.517 mW	Inductor	Inductor power dissipation
16.	C <sub>in</sub> P <sub>d</sub>	265.58 μW	Power	Input capacitor power dissipation
17.	C <sub>out</sub> P <sub>d</sub>	226.58 μW	Power	Output capacitor power dissipation
18.	IC P <sub>d</sub>	216.6 mW	Power	IC power dissipation
19.	L P <sub>d</sub>	40.517 mW	Power	Inductor power dissipation
20.	Total P <sub>d</sub>	257.748 mW	Power	Total Power Dissipation
21.	Duty Cycle	13.006 %	System	Duty cycle
22.	Efficiency	87.474 %	System Information	Steady state efficiency
23.	FootPrint	76.0 mm <sup>2</sup>	System Information	Total Foot Print Area of BOM components
24.	Frequency	570.068 kHz	System Information	Switching frequency
25.	I <sub>out</sub>	1.0 A	System Information	I <sub>out</sub> operating point
26.	Mode	CCM	System Information	Conduction Mode
27.	P <sub>out</sub>	1.8 W	System Information	Total output power
28.	V <sub>in</sub>	15.0 V	System Information	V <sub>in</sub> operating point
29.	V <sub>in</sub> p-p	73.941 mV	System Information	Peak-to-peak input voltage
30.	V <sub>out</sub>	1.8 V	System Information	Operational Output Voltage
31.	V <sub>out</sub> Actual	1.801 V	System Information	V <sub>out</sub> Actual calculated based on selected voltage divider resistors
32.	V <sub>out</sub> Tolerance	3.131 %	System Information	V <sub>out</sub> Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
33.	V <sub>out</sub> p-p	7.902 mV	System Information	Peak-to-peak output ripple voltage

## Design Inputs

Name	Value	Description
I <sub>out</sub>	1.0	Maximum Output Current
V <sub>in</sub> Max	15.0	Maximum input voltage
V <sub>in</sub> Min	9.0	Minimum input voltage
V <sub>out</sub>	1.8	Output Voltage
base_pn	TPS562202	Base Product Number
source	DC	Input Source Type
T <sub>a</sub>	30.0	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

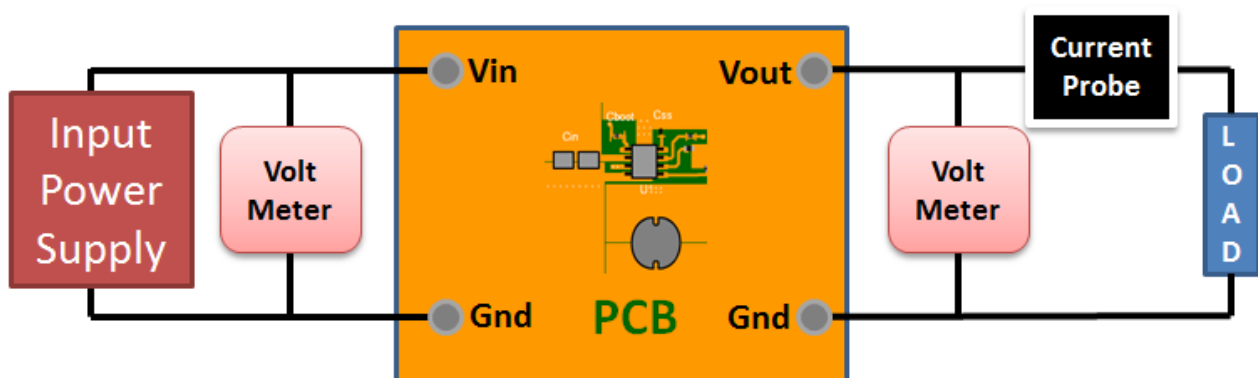
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 9.0V 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.

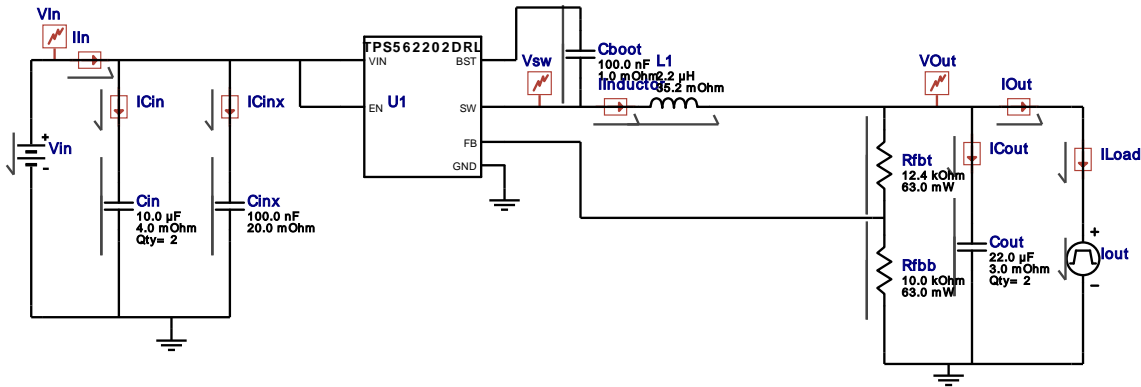
### Load Testing

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.



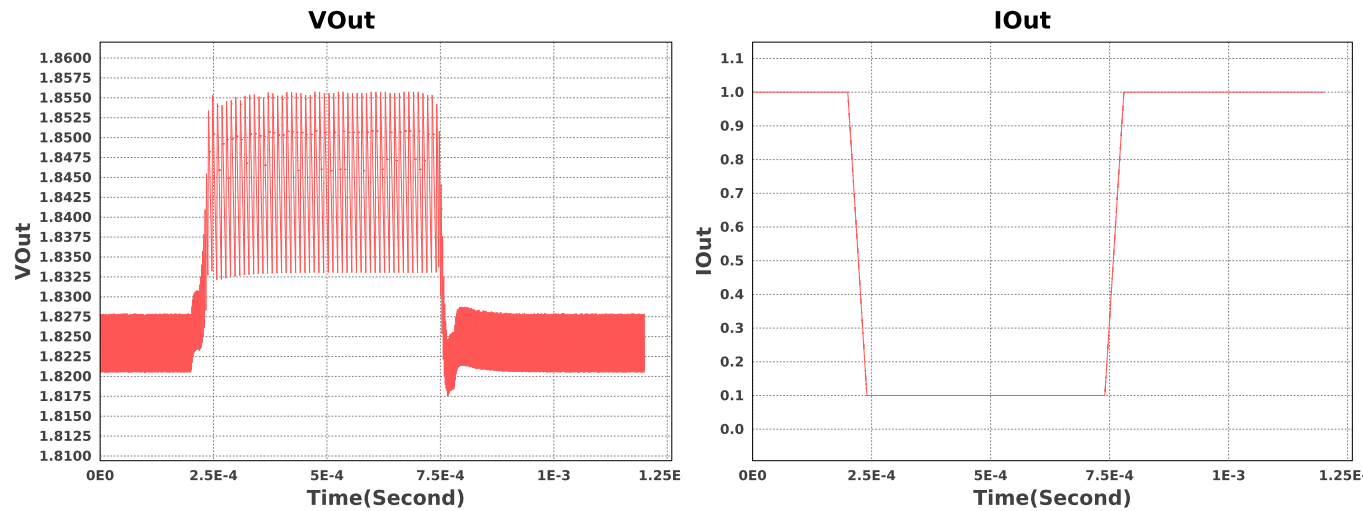
WEBENCH® Electrical Simulation Report

Design Id = 16  
sim\_id = 1  
Simulation Type = Load Transient



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cin	IC	Initial Condition	0 V
2.	L1	IC	Initial Condition	1.0
3.	ILoad	I	Load Current	ILoad1 A
4.	Iout	signal_type	Signal Type	PULSE
		I1	Initial Load Current	1.0 A
		I2	Minimum Load Current	0.1 A
		Td	Initial Time Delay	0.2m s
		Tf	Fall Time	40u s
		Tr	Rise Time	40u s
		Pw	Pulse Width	0.5m s



Design Assistance

- Master key : 7184E8B77D068D1CE343DD0BE1E418A5[v1]
- TPS562202 Product Folder : <http://www.ti.com/product/TPS562202> : contains the data sheet and other resources.

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