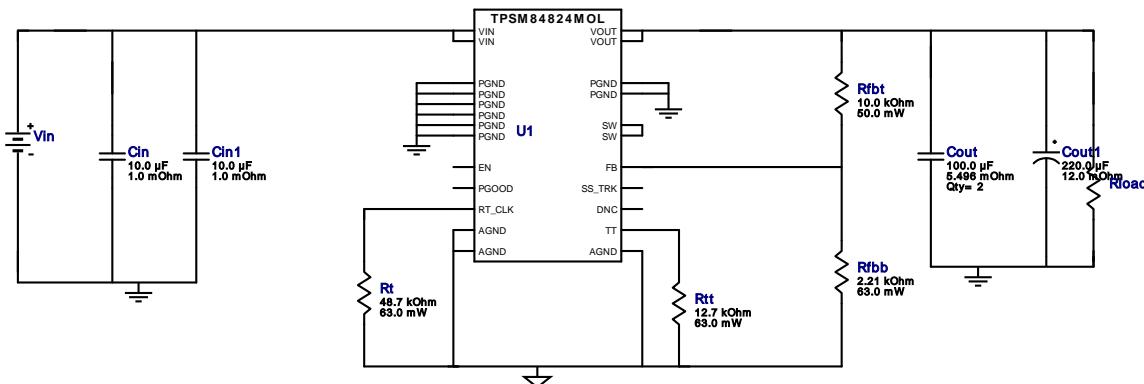


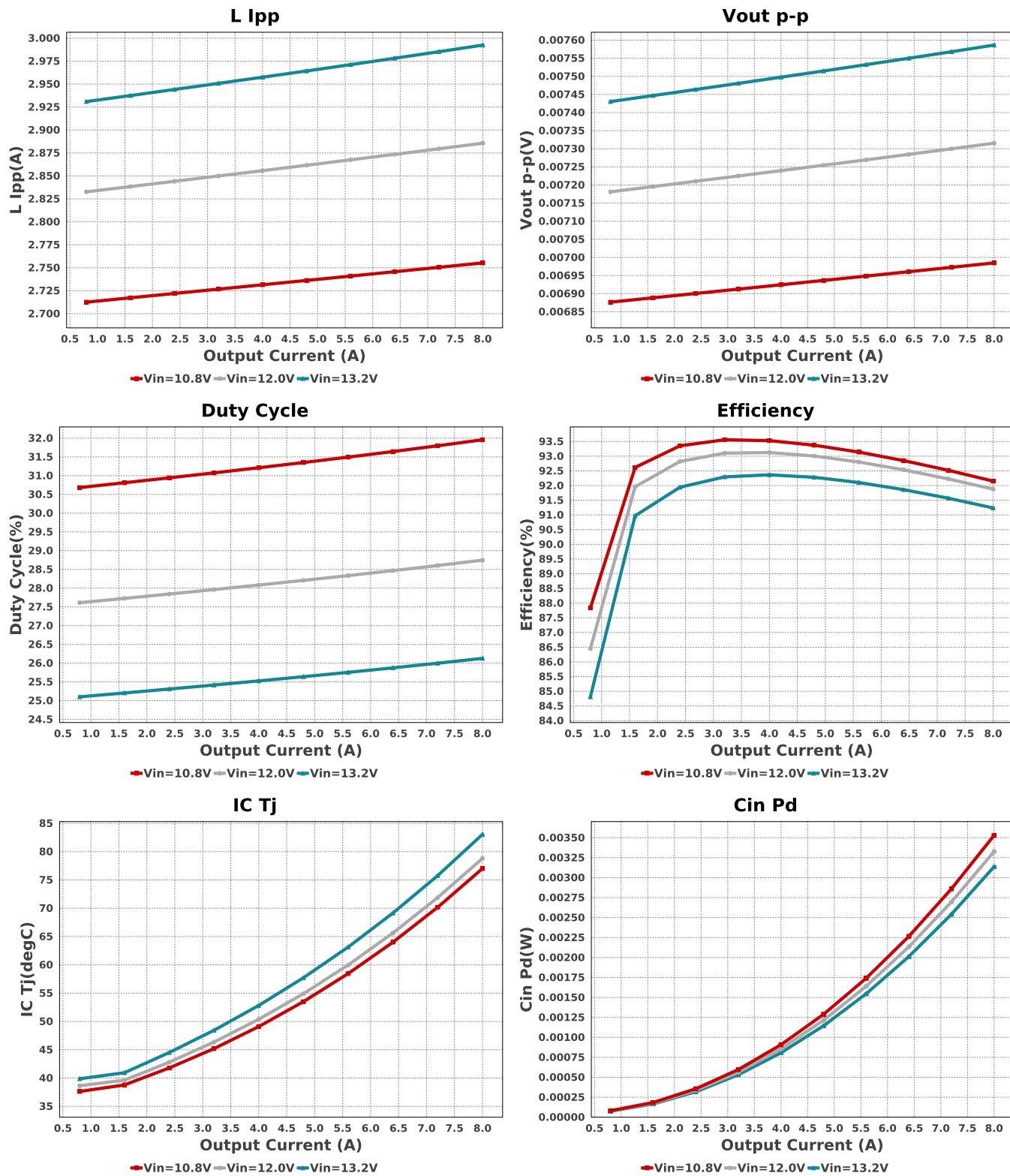
**WEBENCH® Design Report**

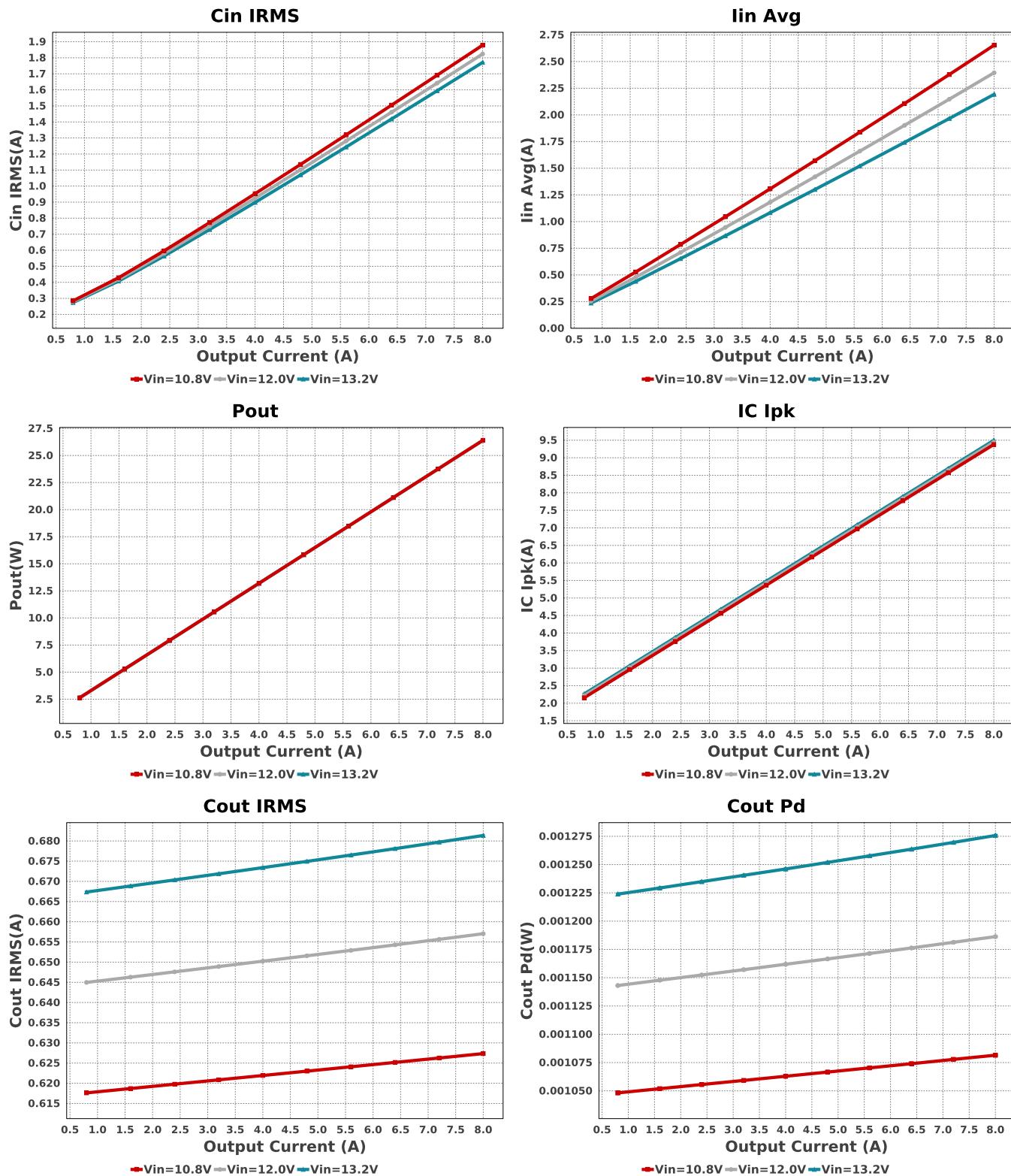
Design : 9200 TPSM84824MOLR  
TPSM84824MOLR 9V-15V to 1.20V @ 6A

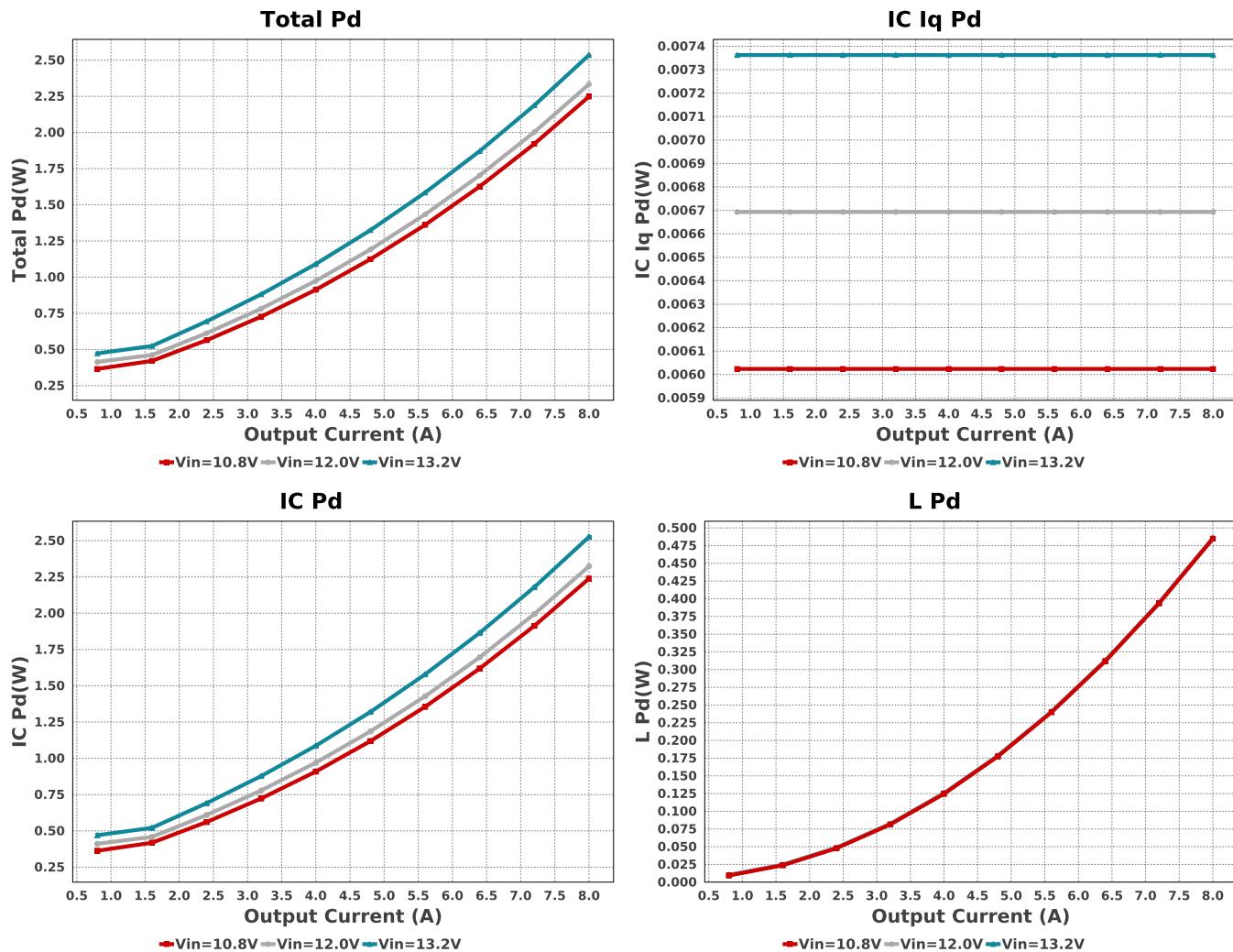
VinMin = 10.8V  
VinMax = 13.2V  
Vout = 3.3V  
Vout Sch = 3.3V  
Iout = 8.0A  
Device = TPSM84824MOLR  
Topology = Buck  
Created = 2025-01-29 01:20:00.407  
BOM Cost = \$7.40  
BOM Count = 10  
Total Pd = 2.54W


**Electrical BOM**

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	TDK	C3225X5R1H106K250AB Series= X5R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 5.0 A	1	\$0.36	1210_280 15 mm <sup>2</sup>
Cin1	TDK	C3225X5R1H106K250AB Series= X5R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 5.0 A	1	\$0.36	1210_280 15 mm <sup>2</sup>
Cout	TDK	C3225X5R0J107M250AC Series= X5R	Cap= 100.0 uF ESR= 5.496 mOhm VDC= 6.3 V IRMS= 3.13651 A	2	\$0.38	1210_280 15 mm <sup>2</sup>
Cout1	Panasonic	6TPF220ML Series= TPF	Cap= 220.0 uF ESR= 12.0 mOhm VDC= 6.3 V IRMS= 4.0 A	1	\$1.13	7343-31 59 mm <sup>2</sup>
Rfb	Vishay-Dale	CRCW04022K21FKED Series= CRCW..e3	Res= 2.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
Rfbt	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	0201 2 mm <sup>2</sup>
Rt	Vishay-Dale	CRCW040248K7FKED Series= CRCW..e3	Res= 48.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
Rtt	Vishay-Dale	CRCW040212K7FKED Series= CRCW..e3	Res= 12.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
U1	Texas Instruments	TPSM84824MOLR	Switcher	1	\$4.75	MOL0024A 90 mm <sup>2</sup>







## Operating Values

#	Name	Value	Category	Description
1.	BOM Count	10		Total Design BOM count
2.	Total BOM	\$7.4		Total BOM Cost
3.	Cin IRMS	1.771 A	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	3.137 mW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	681.355 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	1.276 mW	Capacitor	Output capacitor power dissipation
7.	IC Ipk	9.496 A	IC	Peak switch current in IC
8.	IC Iq Pd	7.362 mW	IC	IC Iq Pd
9.	IC Pd	2.526 W	IC	IC power dissipation
10.	IC T <sub>j</sub>	83.041 degC	IC	IC junction temperature
11.	ICThetaJA Effective	21.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
12.	Iin Avg	2.192 A	IC	Average input current
13.	L Ipp	2.992 A	Inductor	Peak-to-peak inductor ripple current
14.	L Pd	485.6 mW	Inductor	Inductor power dissipation
15.	Cin Pd	3.137 mW	Power	Input capacitor power dissipation
16.	Cout Pd	1.276 mW	Power	Output capacitor power dissipation
17.	IC Pd	2.526 W	Power	IC power dissipation
18.	L Pd	485.6 mW	Power	Inductor power dissipation
19.	Total Pd	2.535 W	Power	Total Power Dissipation
20.	Duty Cycle	26.128 %	System	Duty cycle
			Information	
21.	Efficiency	91.24 %	System	Steady state efficiency
22.	FootPrint	219.0 mm <sup>2</sup>	Information	Total Foot Print Area of BOM components
23.	Frequency	995.676 kHz	Information	Switching frequency
24.	Iout	8.0 A	System	Iout operating point
25.	Mode	CCM	Information	Conduction Mode

#	Name	Value	Category	Description
26.	Pout	26.4 W	System Information	Total output power
27.	Vin	13.2 V	System Information	Vin operating point
28.	Vout	3.3 V	System Information	Operational Output Voltage
29.	Vout Actual	3.315 V	System Information	Vout Actual calculated based on selected voltage divider resistors
30.	Vout Tolerance	2.502 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
31.	Vout p-p	7.586 mV	System Information	Peak-to-peak output ripple voltage

## Design Inputs

Name	Value	Description
Iout	8.0	Maximum Output Current
SoftStart	1.2 ms	Soft Start Time (ms)
VinMax	13.2	Maximum input voltage
VinMin	10.8	Minimum input voltage
Vout	3.3	Output Voltage
base_pn	TPSM84824	Base Product Number
source	DC	Input Source Type
Ta	30.0	Ambient temperature
UserFsw	996.0 k	Customer Selected Frequency
1. Vout Sch	3.3	Output voltage selected

## 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  $L_1$  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

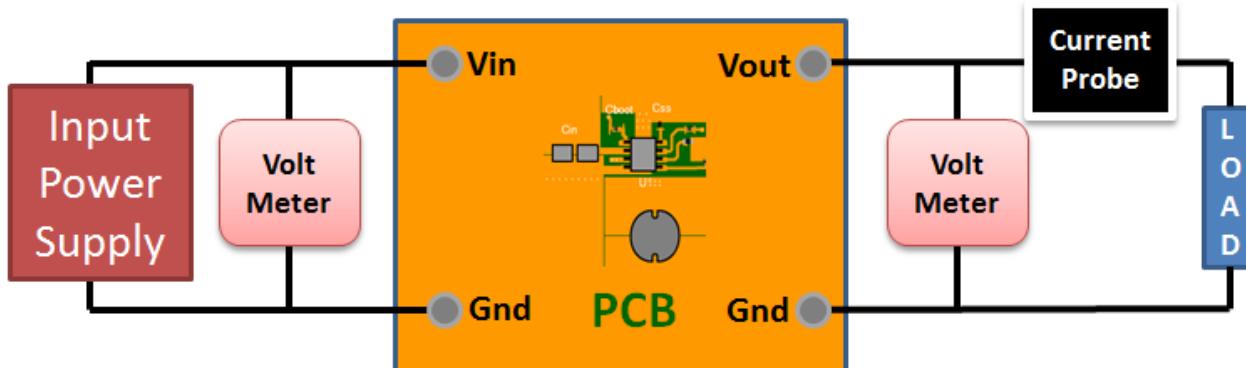
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 10.8V 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  $I_{out}$  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.

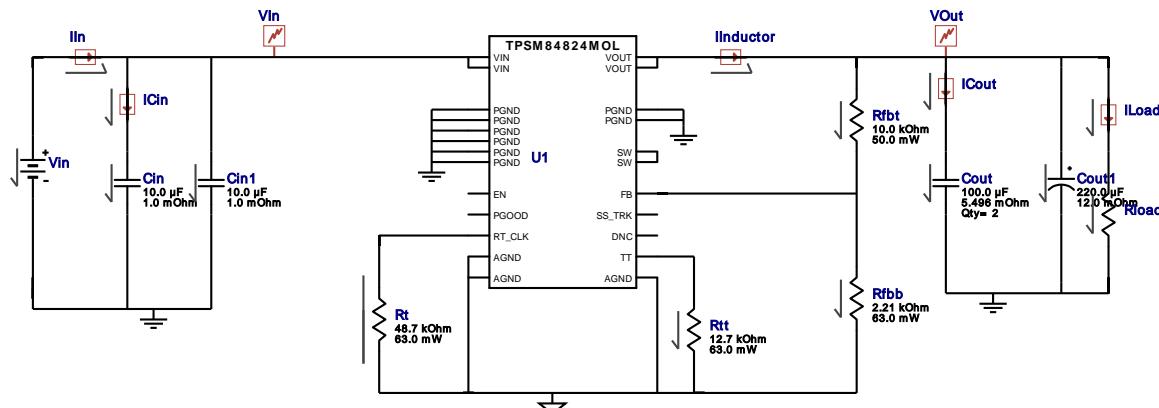


## WEBENCH® Electrical Simulation Report

Design Id = 9200

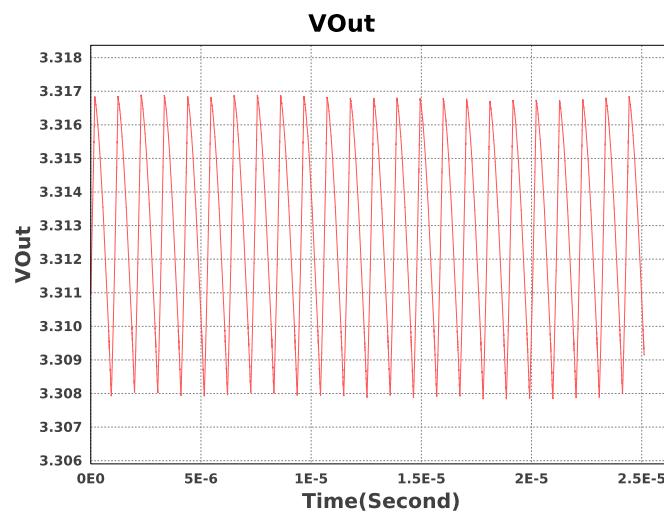
sim\_id = 1

Simulation Type = Steady State



## Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cout	IC	Initial Voltage	3.3 V
2.	Cin	IC	Initial Voltage	12.0 V
3.	Rload	R	Load Resistance	0.4125 Ohm



## Design Assistance

1. Master key : AE3011FD2EE8F4EB[v1]
2. **TPSM84824** Product Folder : <http://www.ti.com/product/TPSM84824> : contains the data sheet and other resources.

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