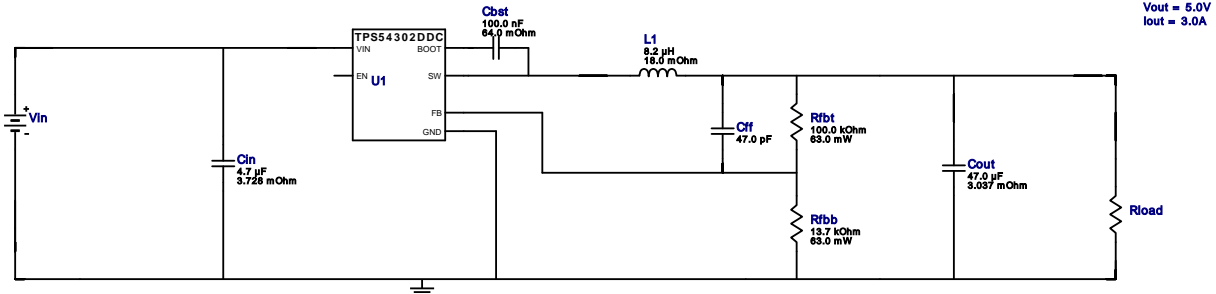




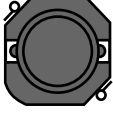





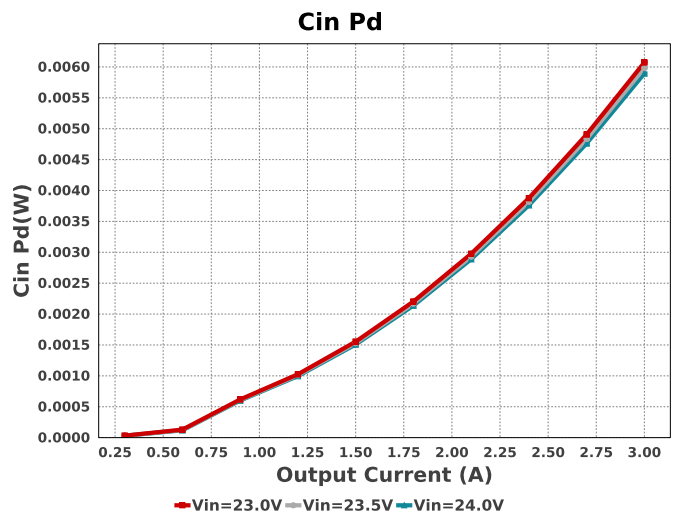
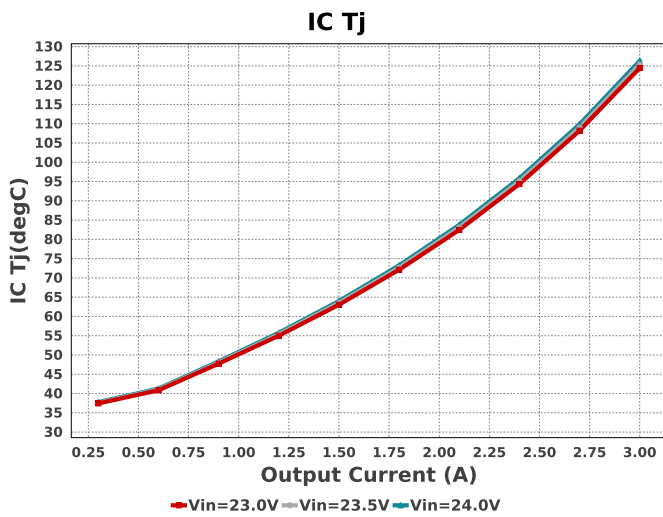
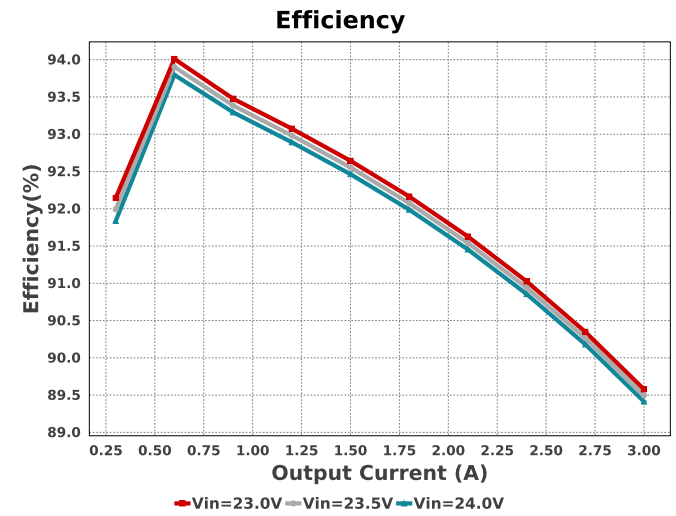
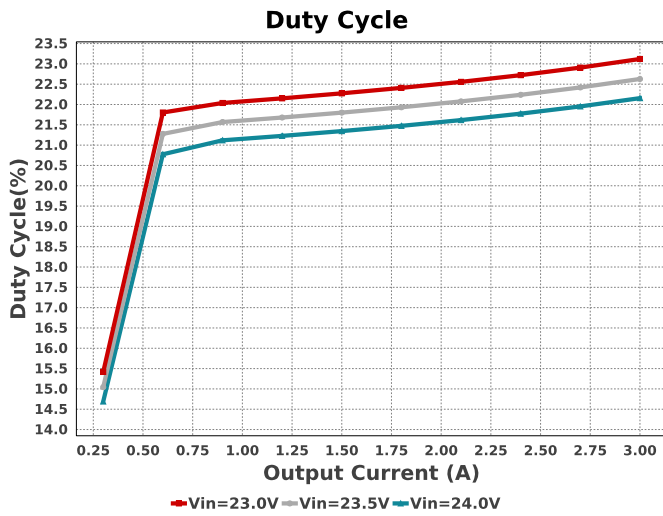
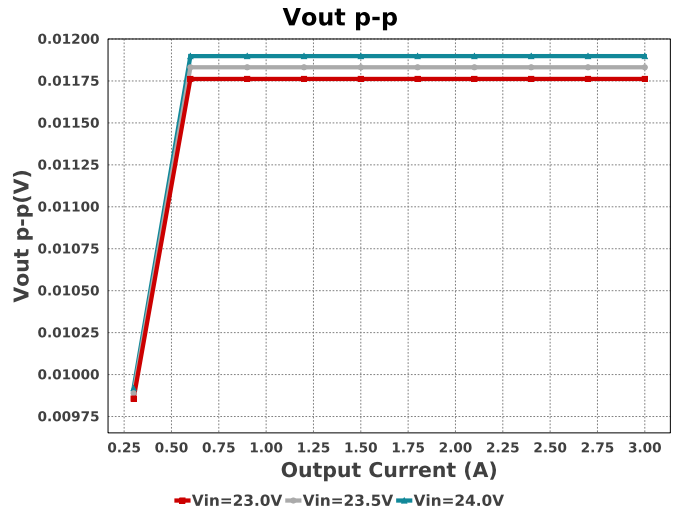
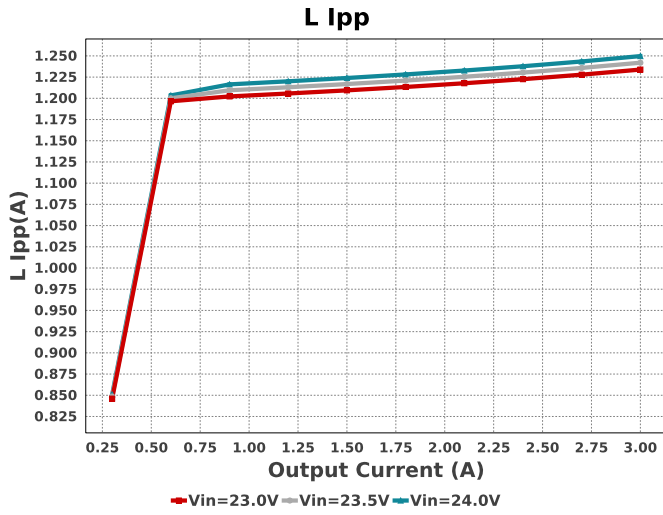
WEBENCH® Design Report

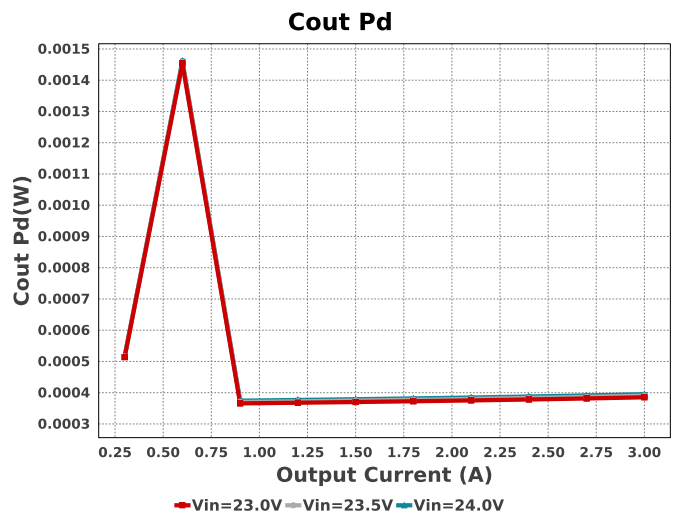
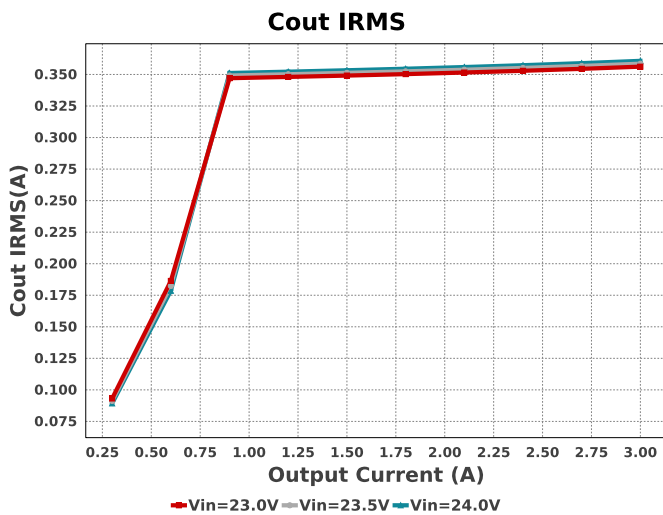
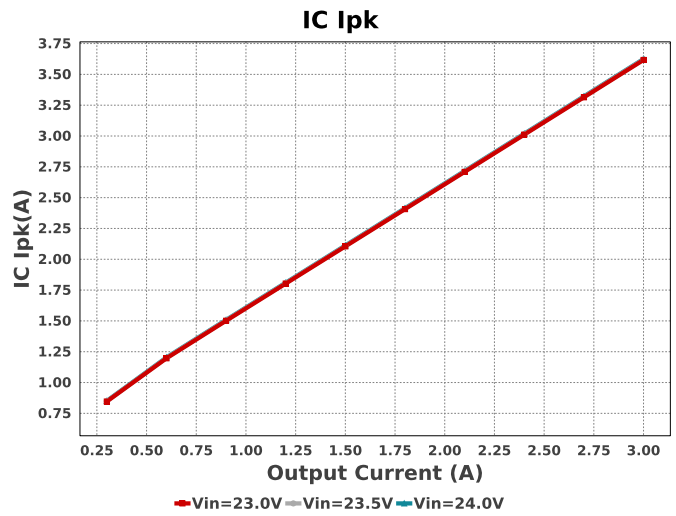
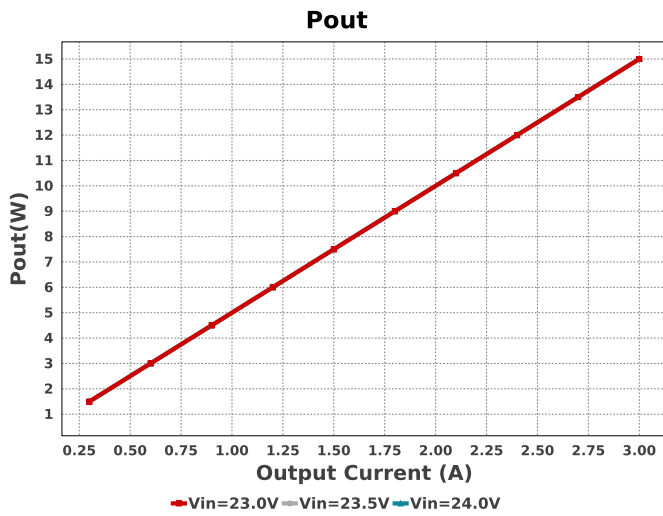
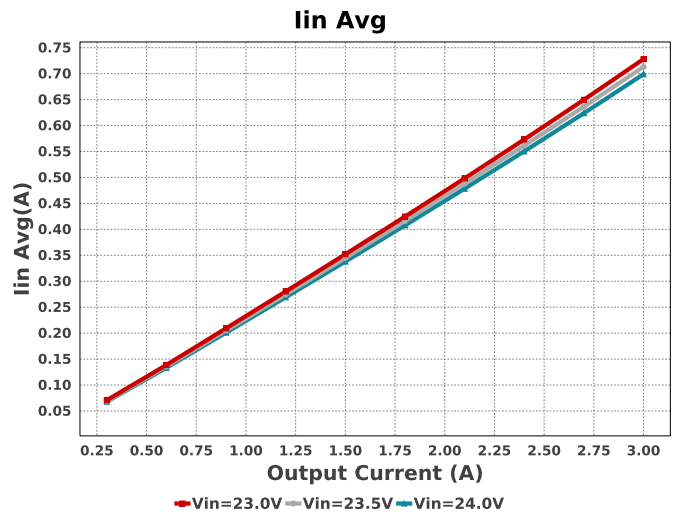
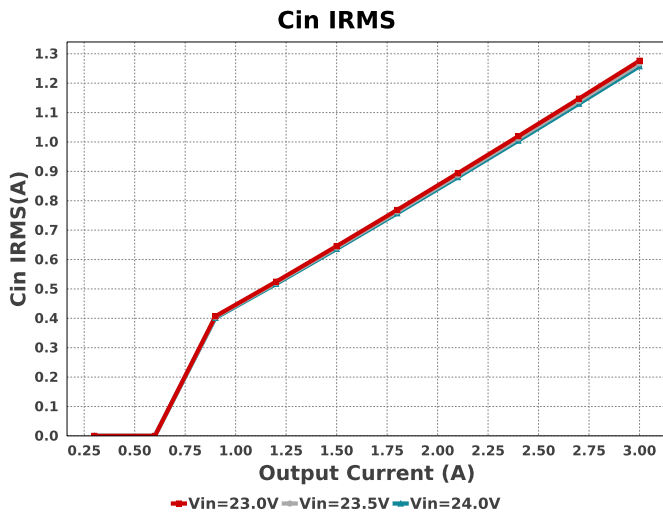
Design : 7 TPS54302DDCR
TPS54302DDCR 23V-24V to 5.00V @ 3A

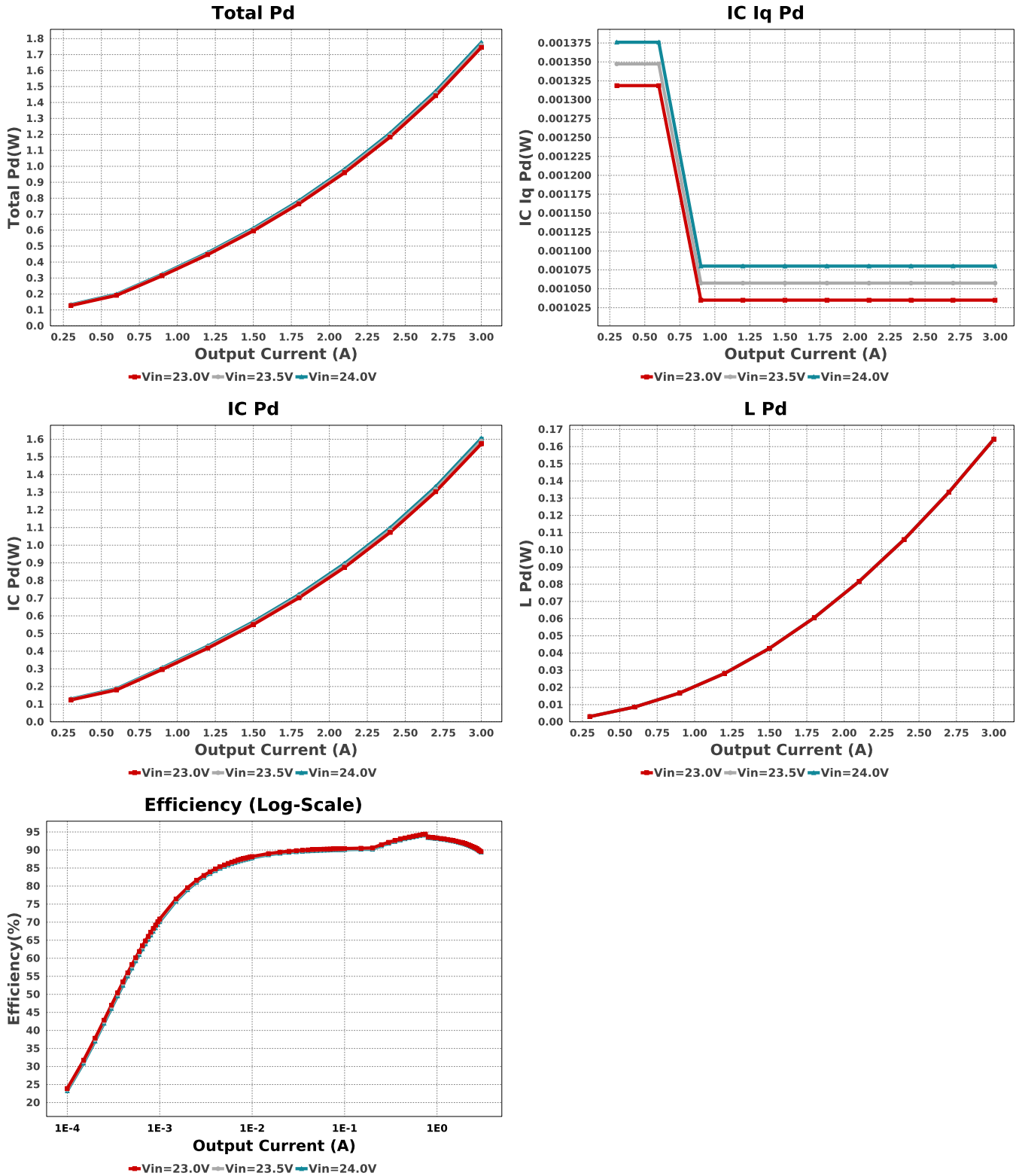


Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	\$0.01	 0805 7 mm ²
Cff	MuRata	GRM0335C1E470JA01D Series= C0G/NP0	Cap= 47.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²
Cin	TDK	C1608X5R1V475K080AC Series= X5R	Cap= 4.7 uF ESR= 3.728 mOhm VDC= 35.0 V IRMS= 2.69359 A	1	\$0.10	 0603 5 mm ²
Cout	MuRata	GRM32ER61C476KE15L Series= X5R	Cap= 47.0 uF ESR= 3.037 mOhm VDC= 16.0 V IRMS= 4.59346 A	1	\$0.17	 1210_280 15 mm ²
L1	Coilcraft	MSS1048-822NLB	L= 8.2 µH 18.0 mOhm	1	\$0.56	 MSS1048 146 mm ²
Rfbb	Vishay-Dale	CRCW040213K7FKED Series= CRCW..e3	Res= 13.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rfbs	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
U1	Texas Instruments	TPS54302DDCR	Switcher	1	\$0.36	 DDC0006A_N 10 mm ²







Operating Values

#	Name	Value	Category	Description
1.	BOM Count	8		Total Design BOM count
2.	Total BOM	\$1.23		Total BOM Cost
3.	Cin IRMS	1.257 A	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	5.894 mW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	360.773 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	395.29 μ W	Capacitor	Output capacitor power dissipation
7.	IC Ipk	3.625 A	IC	Peak switch current in IC
8.	IC Iq Pd	1.08 mW	IC	IC Iq Pd
9.	IC Pd	1.605 W	IC	IC power dissipation
10.	IC Tj	126.304 degC	IC	IC junction temperature
11.	ICThetaJA Effective	60.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance

#	Name	Value	Category	Description
12.	Iin Avg	699.0 mA	IC	Average input current
13.	L Ipp	1.25 A	Inductor	Peak-to-peak inductor ripple current
14.	L Pd	164.34 mW	Inductor	Inductor power dissipation
15.	Cin Pd	5.894 mW	Power	Input capacitor power dissipation
16.	Cout Pd	395.29 μ W	Power	Output capacitor power dissipation
17.	IC Pd	1.605 W	Power	IC power dissipation
18.	L Pd	164.34 mW	Power	Inductor power dissipation
19.	Total Pd	1.776 W	Power	Total Power Dissipation
20.	Duty Cycle	22.156 %	System Information	Duty cycle
21.	Efficiency	89.414 %	System Information	Steady state efficiency
22.	FootPrint	191.0 mm ²	System Information	Total Foot Print Area of BOM components
23.	Frequency	400.0 kHz	System Information	Switching frequency
24.	Iout	3.0 A	System Information	Iout operating point
25.	Mode	CCM	System Information	PWM/PFM Mode
26.	Pout	15.0 W	System Information	Total output power
27.	Vin	24.0 V	System Information	Vin operating point
28.	Vout Actual	4.946 V	System Information	Vout Actual calculated based on selected voltage divider resistors
29.	Vout Tolerance	1.777 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
30.	Vout p-p	11.898 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	3.0	Maximum Output Current
VinMax	24.0	Maximum input voltage
VinMin	23.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	TPS54302	Base Product Number
source	DC	Input Source Type
Ta	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

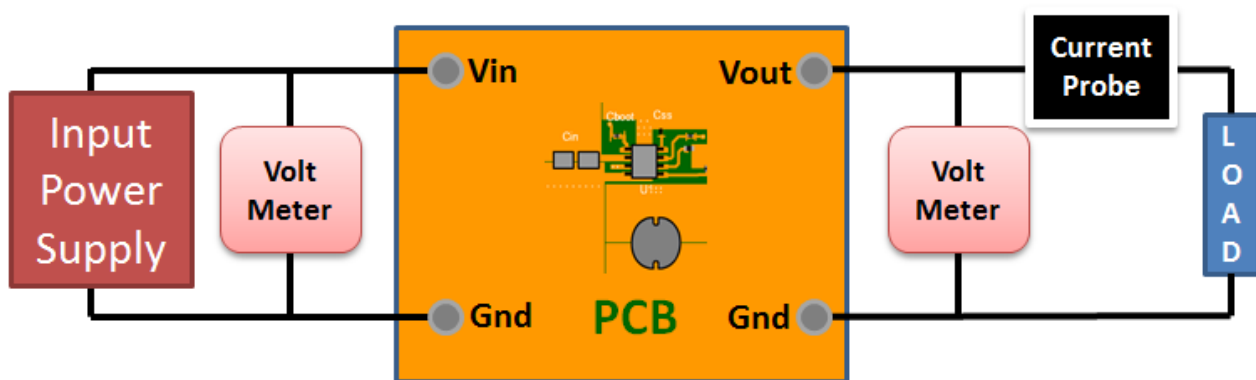
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 23.0V 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.

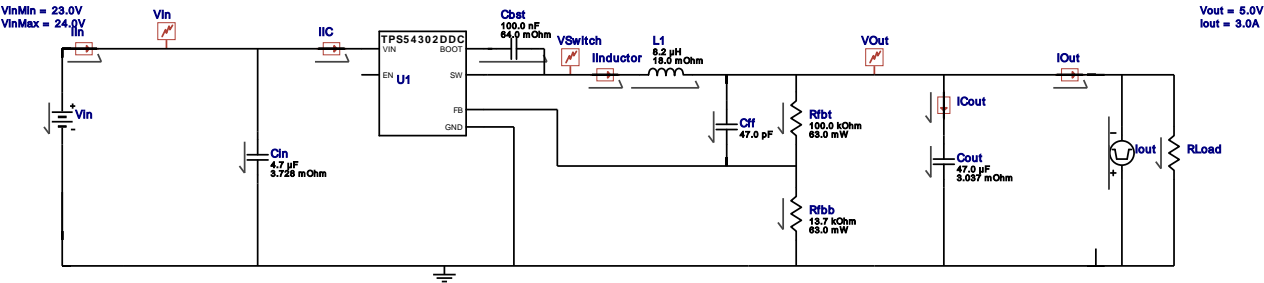
Load Testing

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.



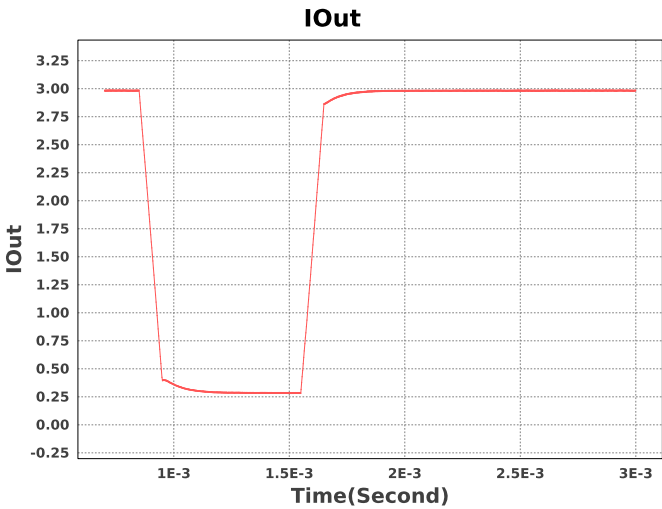
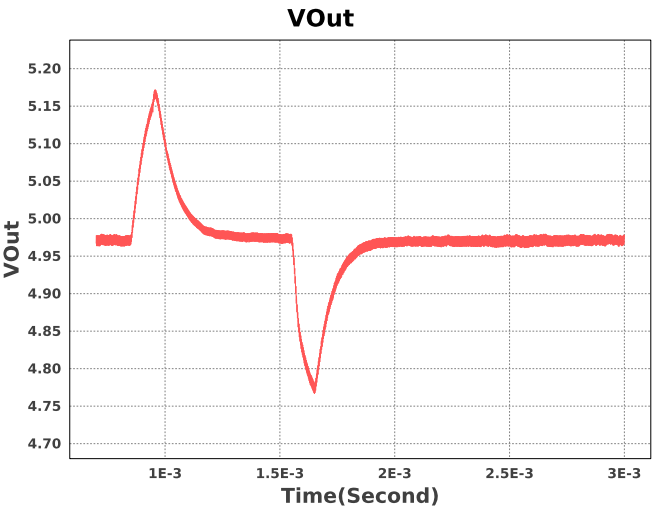
WEBENCH® Electrical Simulation Report

Design Id = 7
sim_id = 1
Simulation Type = Load Transient



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	L1	IC	Initial Current	-3.0 V
2.	Cbst	IC	Initial Voltage	23.0 V
3.	Iout	signal_type	Signal Type	PULSE
		I1	Initial Load Current	0 A
		I2	Minimum Load Current	2.7 A
		Td	Initial Time Delay	850u s
		Tf	Fall Time	100u s
		Tr	Rise Time	100u s
		Pw	Pulse Width	600u s
4.	RLoad	R	Load Resistance	1.666666666666667 Ohm



Design Assistance

- Master key : F4EB81FB91CF830618D3C23BCBEE23FC[v1]
- TPS54302** Product Folder : <http://www.ti.com/product/TPS54302> : contains the data sheet and other resources.

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