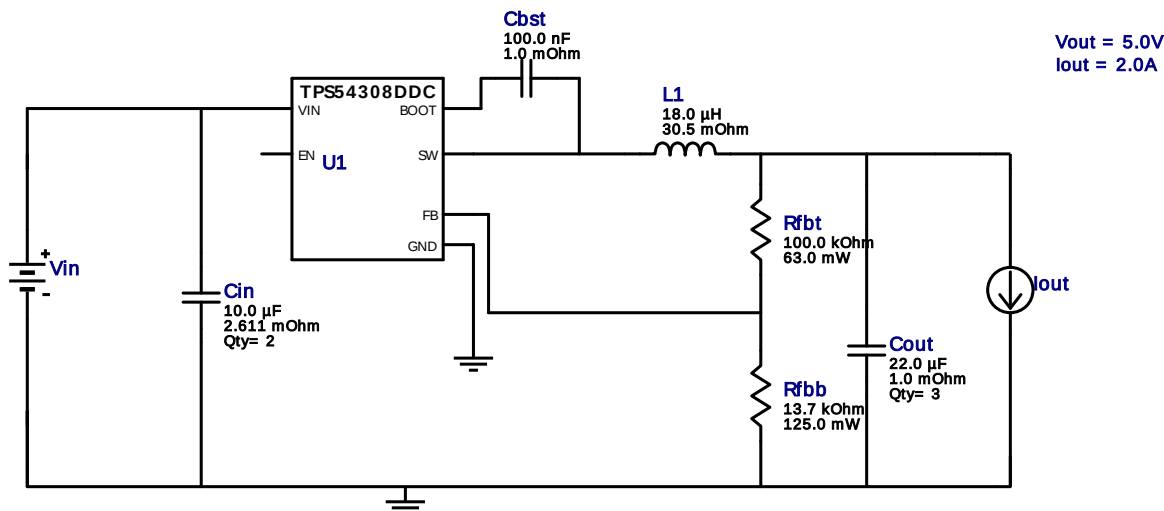
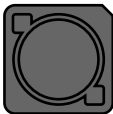


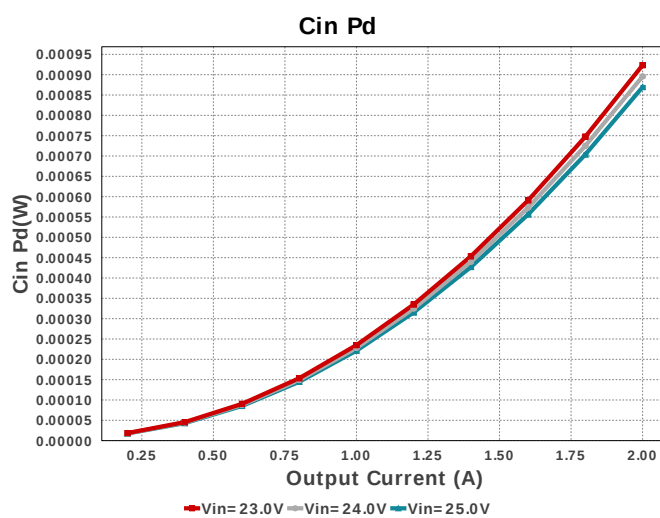
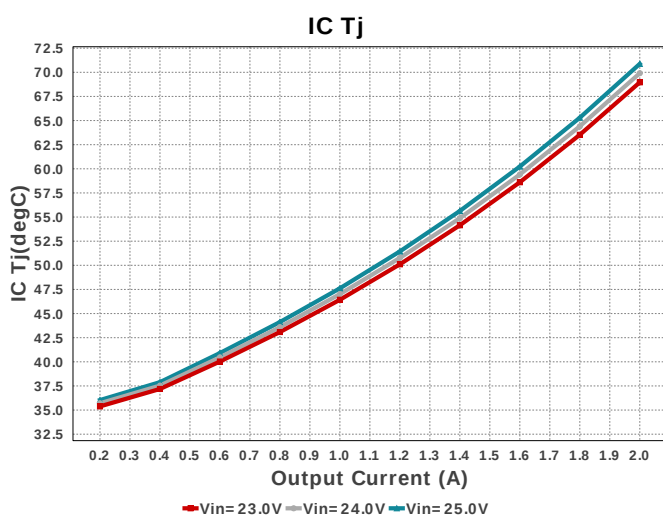
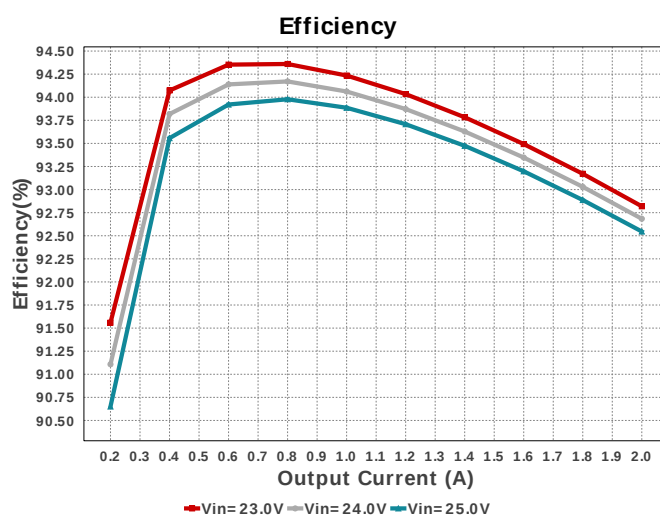
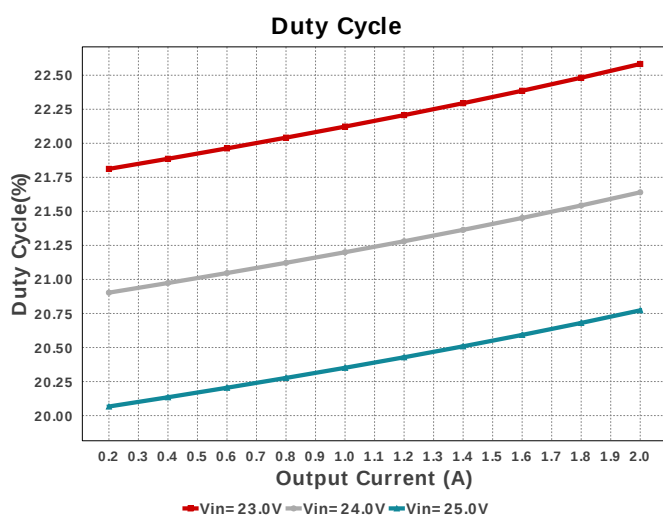
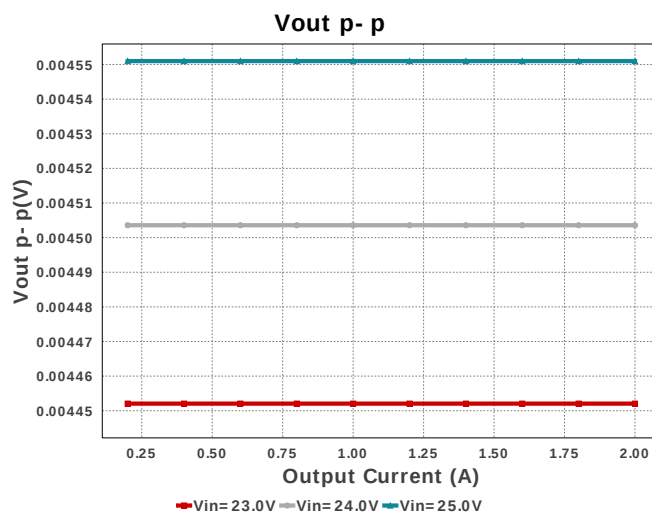
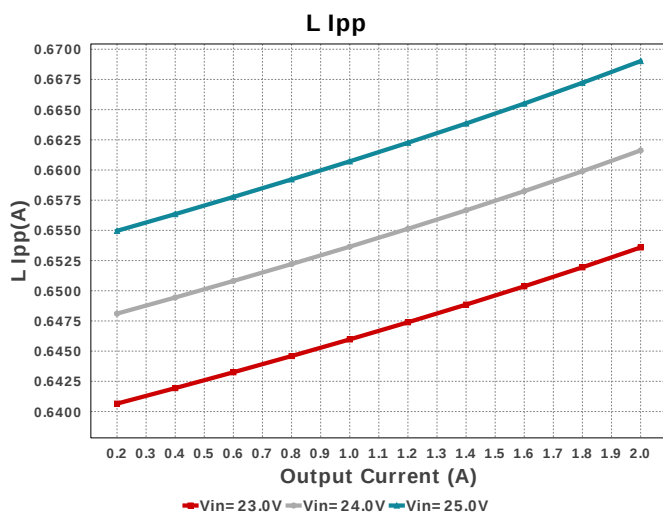
WEBENCH® Design Report

Design : 223 TPS54308DDCR
TPS54308DDCR 23V-25V to 5.00V @ 2A

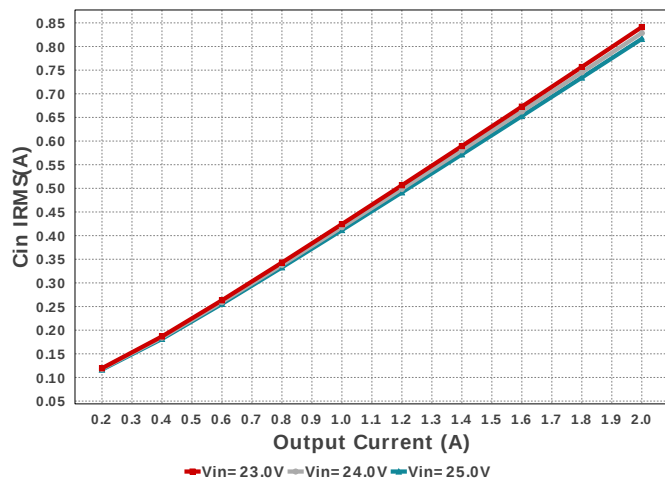


Electrical BOM

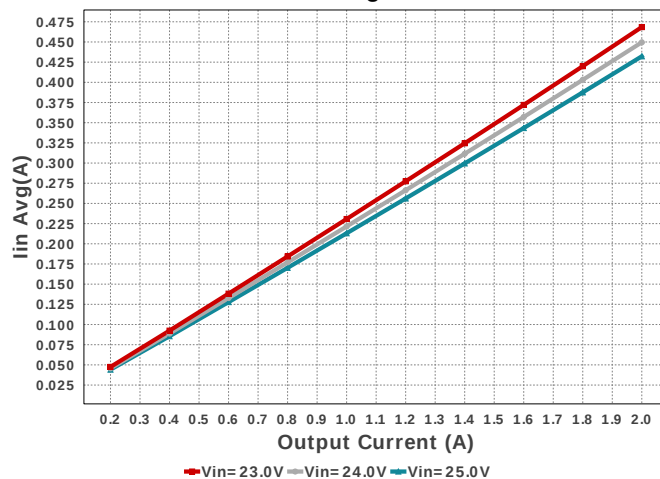
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	Yageo	CC0805KRX7R9BB104 Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	\$0.02	 0805 7 mm ²
Cin	TDK	CGA9N3X7R1H106K230KB Series= X7R	Cap= 10.0 uF ESR= 2.611 mOhm VDC= 50.0 V IRMS= 5.6501 A	2	\$0.96	 2220_250 54 mm ²
Cout	AVX	12103D226MAT2A Series= X5R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	3	\$0.31	 1210 15 mm ²
L1	Würth Elektronik	7447798181	L= 18.0 uH DCR= 30.5 mOhm	1	\$2.23	 WE-PDF-1045 149 mm ²
Rfbb	Panasonic	ERJ-6ENF1372V Series= ERJ-6E	Res= 13.7 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
Rfbt	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	TPS54308DDCR	Switcher	1	\$0.60	 DDC0006A_N 10 mm ²



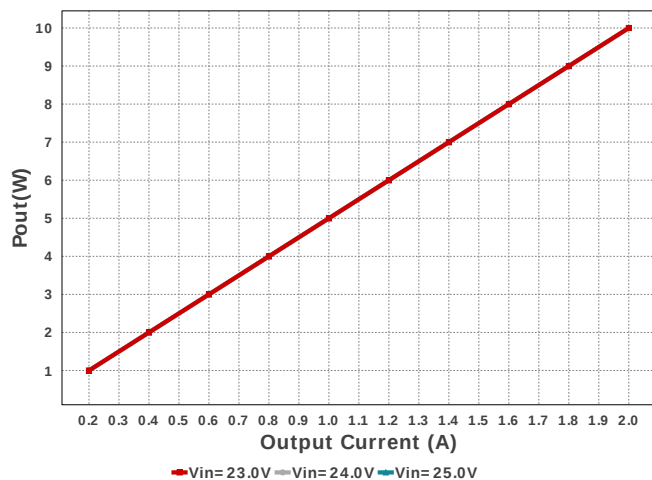
Cin IRMS



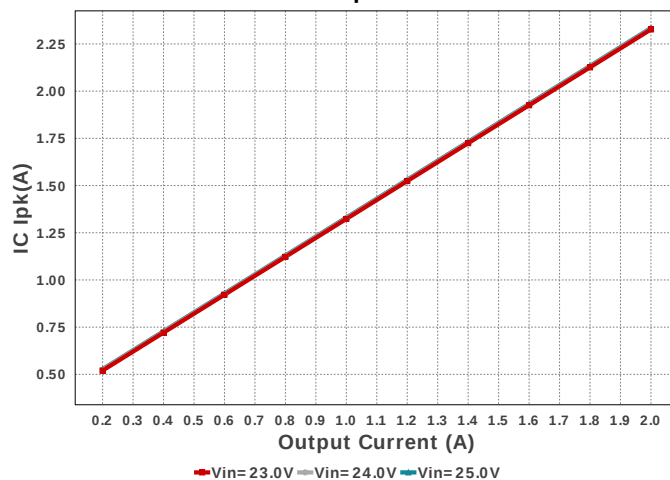
Iin Avg



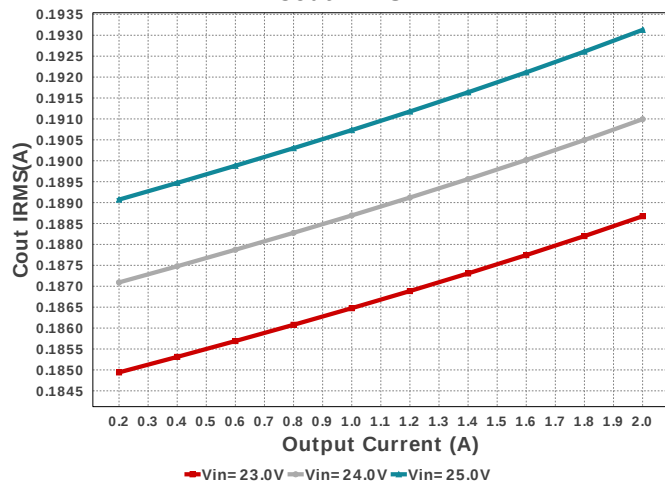
Pout



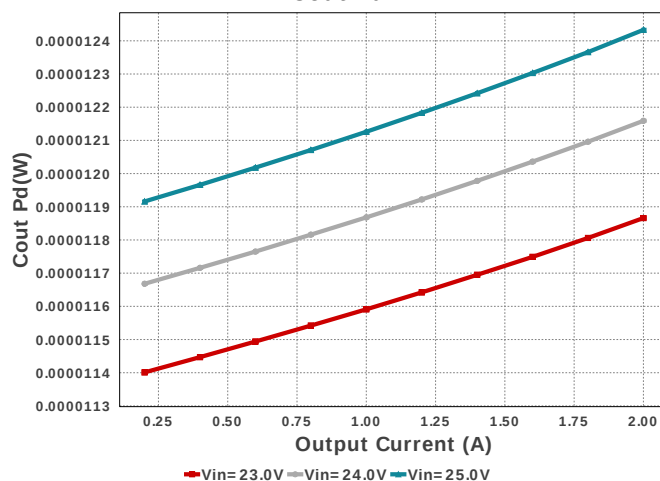
IC Ipk

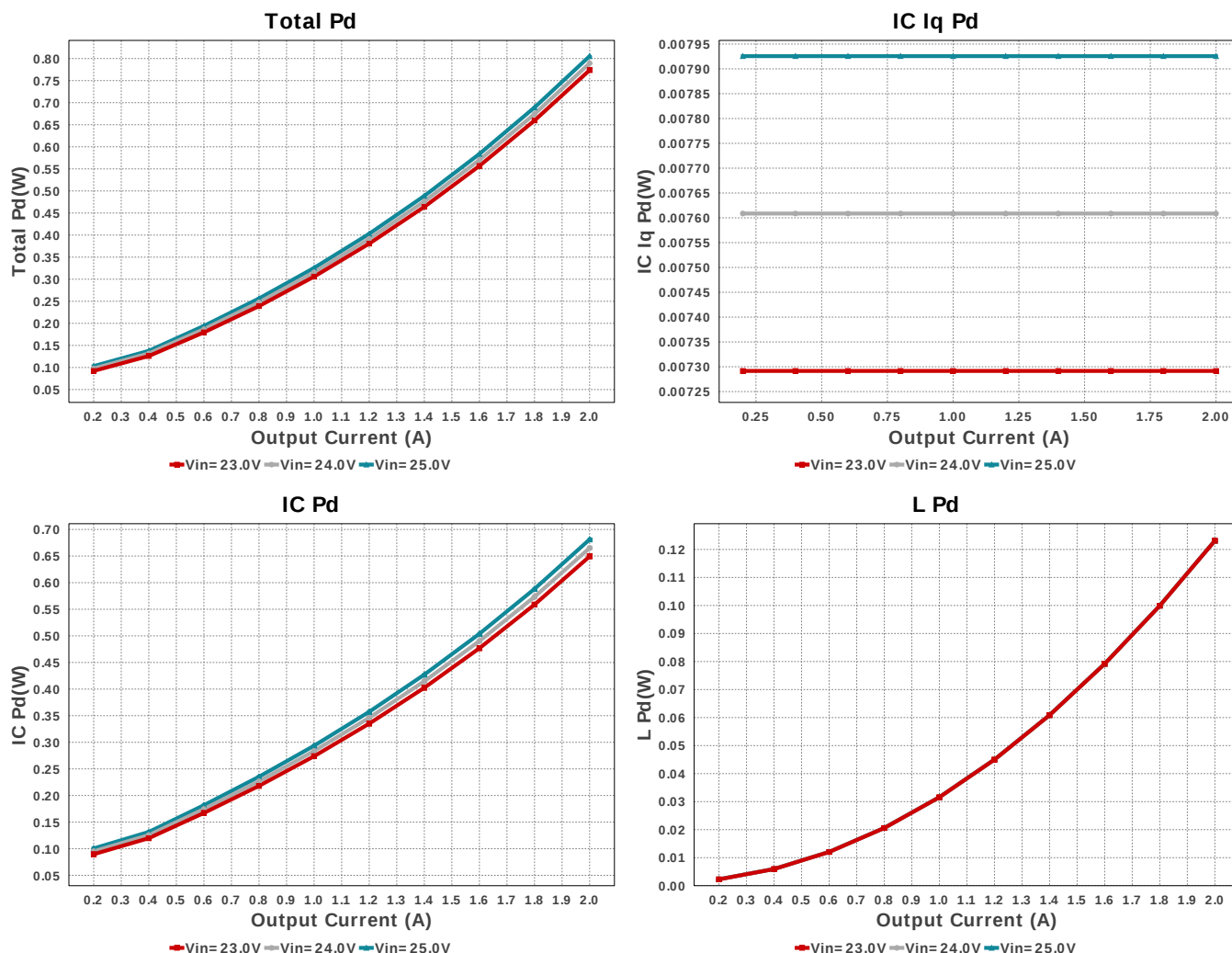


Cout IRMS



Cout Pd





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	816.126 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	869.54 μ W	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	193.129 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	12.433 μ W	Capacitor	Output capacitor power dissipation
5.	IC Ipk	2.335 A	IC	Peak switch current in IC
6.	IC Iq Pd	7.926 mW	IC	IC Iq Pd
7.	IC Pd	681.23 mW	IC	IC power dissipation
8.	IC Tj	70.874 degC	IC	IC junction temperature
9.	ICThetaJA Effective	60.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
10.	Iin Avg	432.22 mA	IC	Average input current
11.	L Ipp	669.02 mA	Inductor	Peak-to-peak inductor ripple current
12.	L Pd	123.14 mW	Inductor	Inductor power dissipation
13.	Cin Pd	869.54 μ W	Power	Input capacitor power dissipation
14.	Cout Pd	12.433 μ W	Power	Output capacitor power dissipation
15.	IC Pd	681.23 mW	Power	IC power dissipation
16.	L Pd	123.14 mW	Power	Inductor power dissipation
17.	Total Pd	805.442 mW	Power	Total Power Dissipation
18.	BOM Count	10	System	Total Design BOM count
19.	Duty Cycle	20.773 %	System	Duty cycle
20.	Efficiency	92.546 %	System	Steady state efficiency
21.	FootPrint	328.0 mm ²	System	Total Foot Print Area of BOM components
22.	Frequency	340.0 kHz	System	Switching frequency
23.	Iout	2.0 A	System	Iout operating point
24.	Mode	CCM	System	PWM/PFM Mode

#	Name	Value	Category	Description
25.	Pout	10.0 W	System Information	Total output power
26.	Total BOM	\$5.72	System Information	Total BOM Cost
27.	Vin	25.0 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	4.551 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	2.0	Maximum Output Current
VinMax	25.0	Maximum input voltage
VinMin	23.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	TPS54308	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

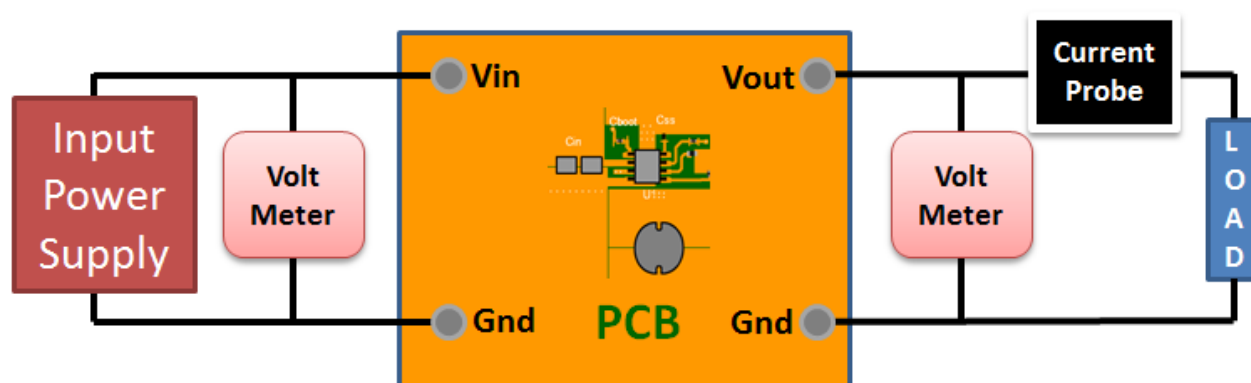
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins.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



Design Assistance

1. Master key : 7EC0CFB3FD0F9F0B[v1]
2. **TPS54308** Product Folder : <http://www.ti.com/product/TPS54308> : contains the data sheet and other resources.

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