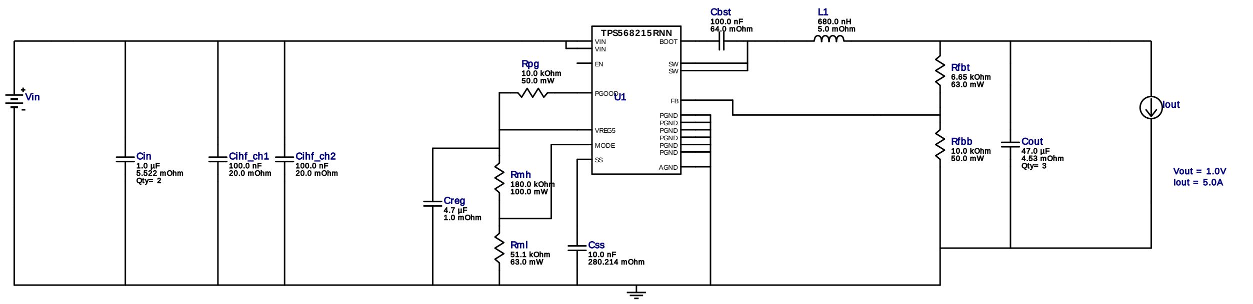
VinMin = 11.5V
VinMax = 12.5V
Vout = 1.0V
Iout = 5.0A

Device = TPS568215RNNR
Topology = Buck
Created = 2020-09-15 05:04:12.726
BOM Cost = $3.16
BOM Count = 17
Total Pd = 1.64W

WEBENCH ® Design Report

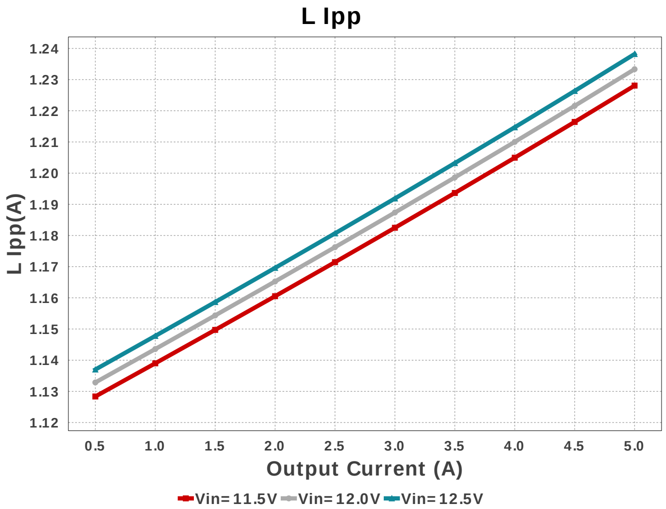
Design : 95 TPS568215RNNR
TPS568215RNNR 11.5V-12.5V to 1.00V @ 5A

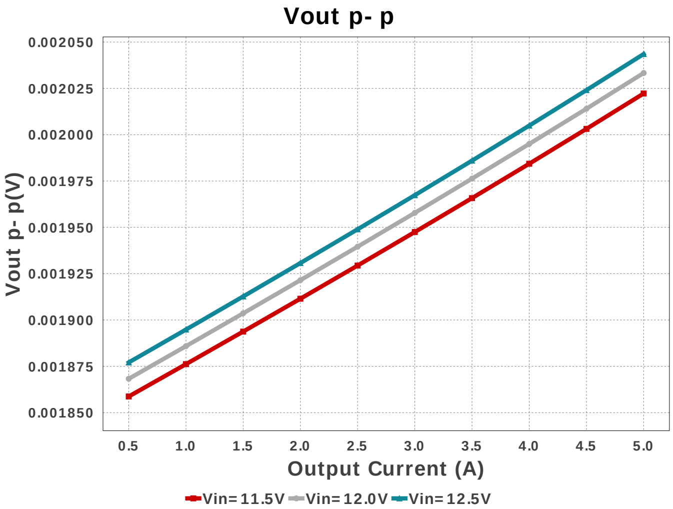


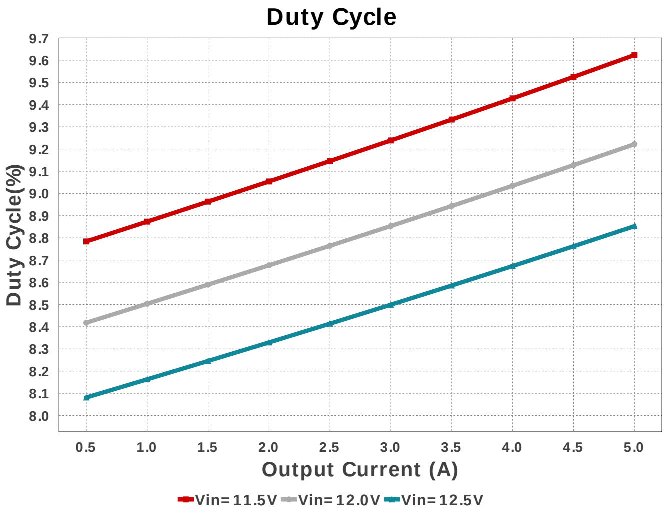
Electrical BOM

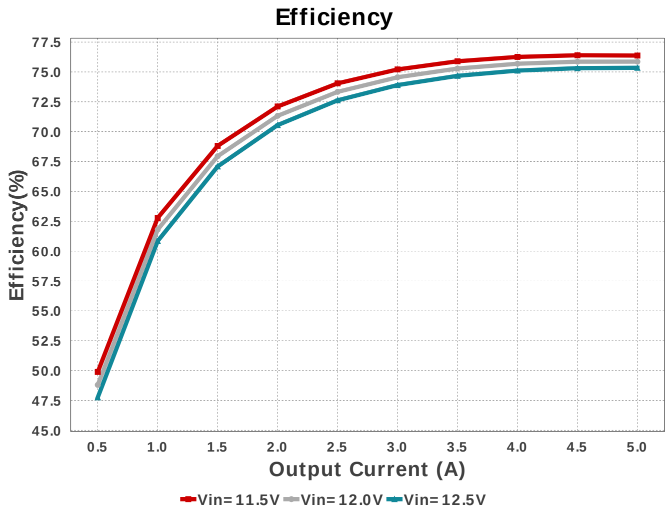
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
Cihf_ch1	MuRata	GRM188R71H104KA93D Series= X7R	Cap= 100.0 nF ESR= 20.0 mOhm VDC= 50.0 V IRMS= 3.8 A	1	$0.02	0603 5 mm²
Cihf_ch2	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 mm²
Cin	TDK	C1608X7R1V105K080AC Series= X7R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 35.0 V IRMS= 2.2162 A	2	$0.05	0603 5 mm²
Cout	TDK	C4532X5R1A476M280KA Series= X5R	Cap= 47.0 uF ESR= 4.53 mOhm VDC= 10.0 V IRMS= 3.6038 A	3	$0.47	1812_320 23 mm²
Creg	Taiyo Yuden	TMK212BJ475KG-T Series= X5R	Cap= 4.7 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.06	0805 7 mm²
Css	TDK	CGA1A2X7R1A103K030BA Series= X7R	Cap= 10.0 nF ESR= 280.21 mOhm VDC= 10.0 V IRMS= 245.72 mA	1	$0.01	0201_033 2 mm²
L1	NIC Components	NPI31PR68MTRF	L= 680.0 nH 5.0 mOhm	1	$0.29	IND_NPI31P 185 mm²
Rfbb	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm²
Rfbt	Vishay-Dale	CRCW04026K65FKED Series= CRCW..e3	Res= 6.65 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rmh	Yageo	RC0603FR-07180KL Series= ?	Res= 180.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rml	Vishay-Dale	CRCW040251K1FKED Series= CRCW..e3	Res= 51.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rpg	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
U1	Texas Instruments	TPS568215RNNR	Switcher	1	$1.19	RNN0018A 20 mm^2

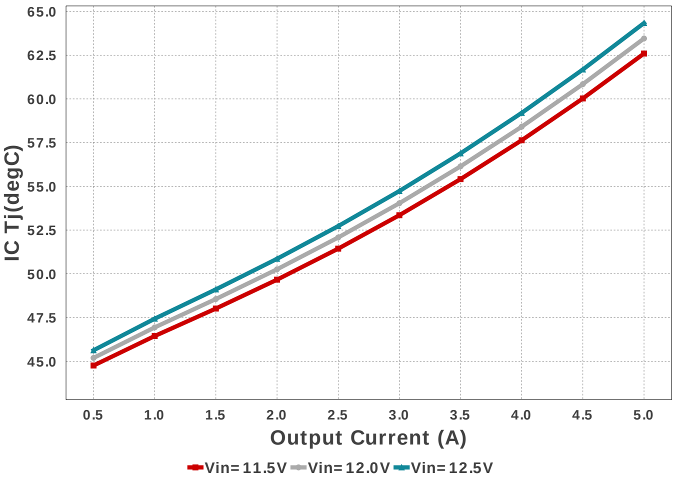




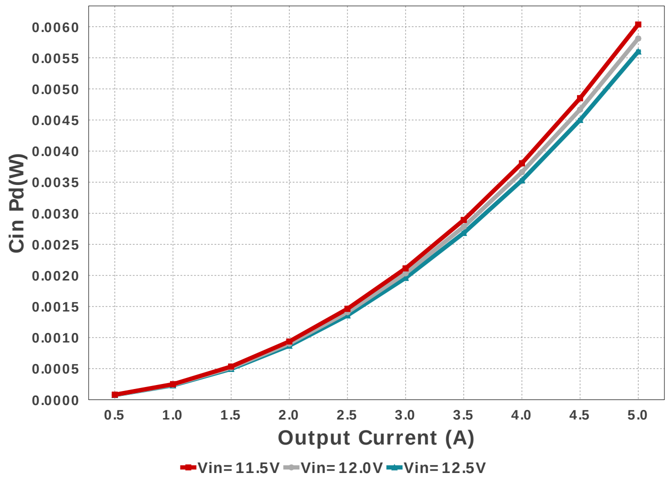




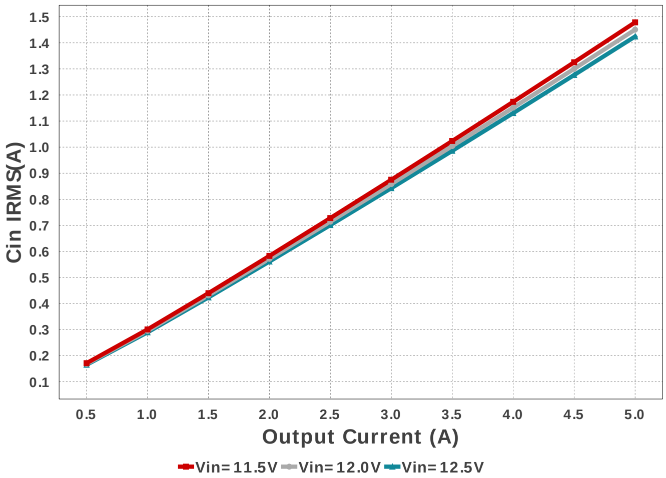
IC Tj



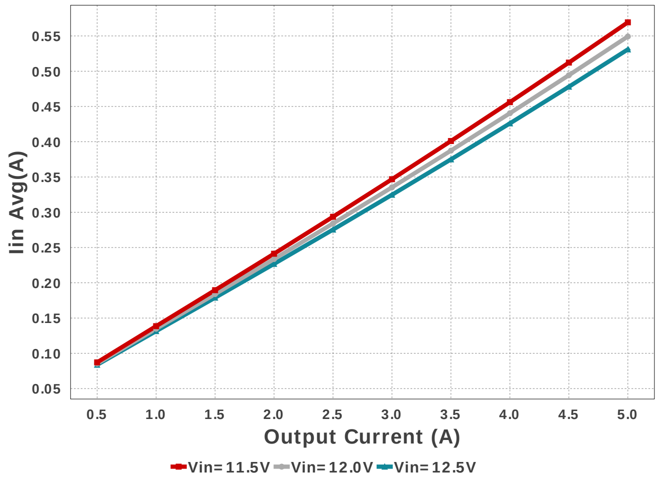
Cin Pd



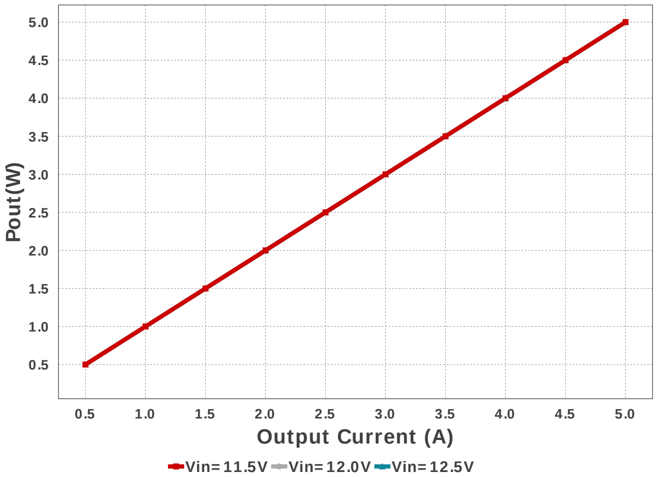
Cin IRMS



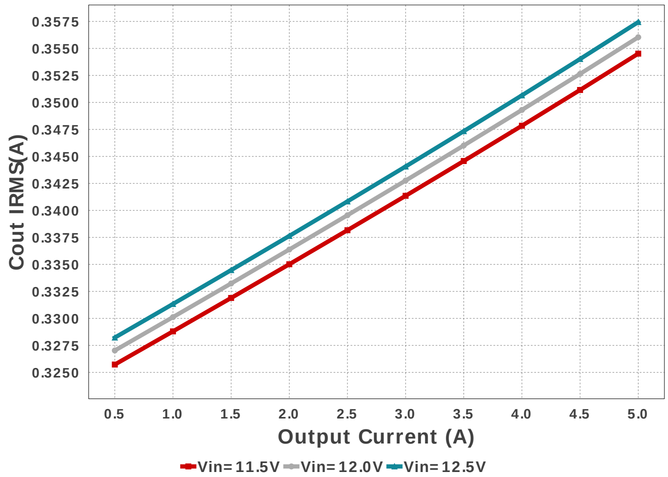
Iin Avg

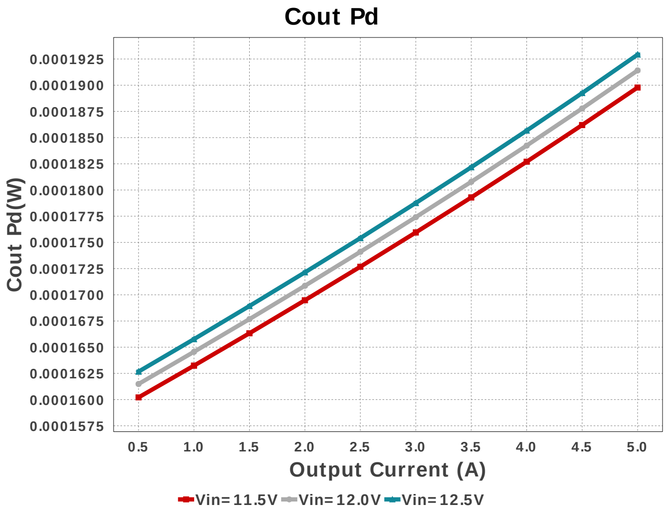


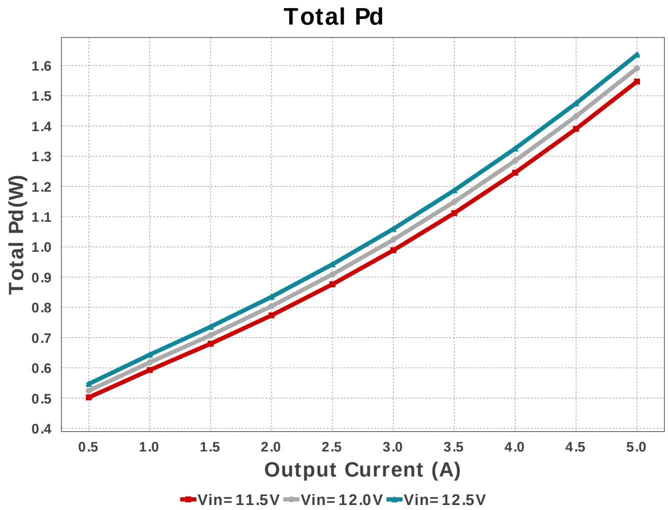
Pout

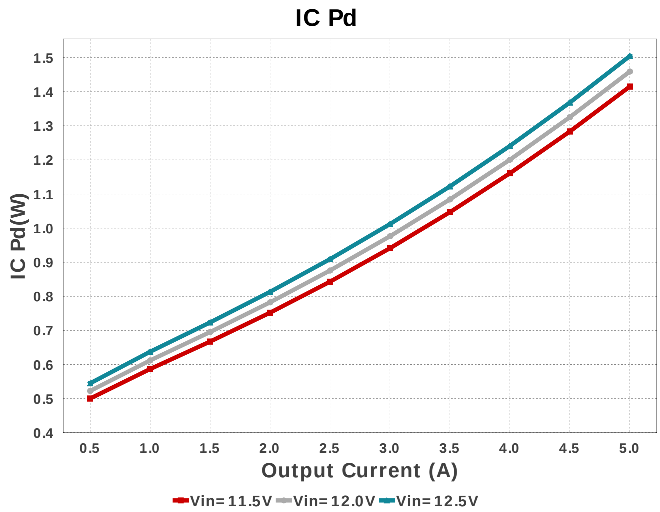


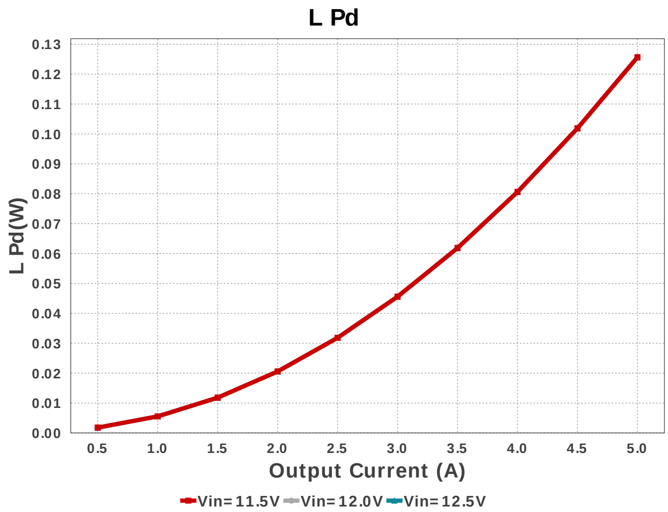
Cout IRMS











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.424 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	5.601 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	357.438 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	192.92 µW	Capacitor	Output capacitor power dissipation
5.	IC Pd	1.504 W	IC	IC power dissipation
6.	IC Tj	64.337 degC	IC	IC junction temperature
7.	ICThetaJA Effective	19.5 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
8.	Iin Avg	530.88 mA	IC	Average input current
9.	L Ipp	1.238 A	Inductor	Peak-to-peak inductor ripple current
10.	L Pd	125.64 mW	Inductor	Inductor power dissipation
11.	Cin Pd	5.601 mW	Power	Input capacitor power dissipation
12.	Cout Pd	192.92 µW	Power	Output capacitor power dissipation
13.	IC Pd	1.504 W	Power	IC power dissipation
14.	L Pd	125.64 mW	Power	Inductor power dissipation
15.	Total Pd	1.636 W	Power	Total Power Dissipation
16.	BOM Count	17	System Information	Total Design BOM count
17.	Duty Cycle	8.853 %	System Information	Duty cycle
18.	Efficiency	75.347 %	System Information	Steady state efficiency
19.	FootPrint	323.0 mm^2	System Information	Total Foot Print Area of BOM components
20.	Frequency	1.191 MHz	System Information	Switching frequency
21.	Iout	5.0 A	System Information	Iout operating point
22.	Mode	CCM	System Information	Conduction Mode
23.	Pout	5.0 W	System Information	Total output power

#	Name	Value	Category	Description
24.	Total BOM	$3.16	System Information	Total BOM Cost
25.	Vin	12.5 V	System Information	Vin operating point
26.	Vout	1.0 V	System Information	Operational Output Voltage
27.	Vout Actual	999.0 mV	System Information	Vout Actual calculated based on selected voltage divider resistors
28.	Vout Tolerance	2.319 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
29.	Vout p-p	2.044 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	5.0	Maximum Output Current
SoftStart	1.0 ms	Soft Start Time (ms)
VinMax	12.5	Maximum input voltage
VinMin	11.5	Minimum input voltage
Vout	1.0	Output Voltage
base_pn	TPS568215	Base Product Number
source	DC	Input Source Type
Ta	35.0	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 Cin and Cout, 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

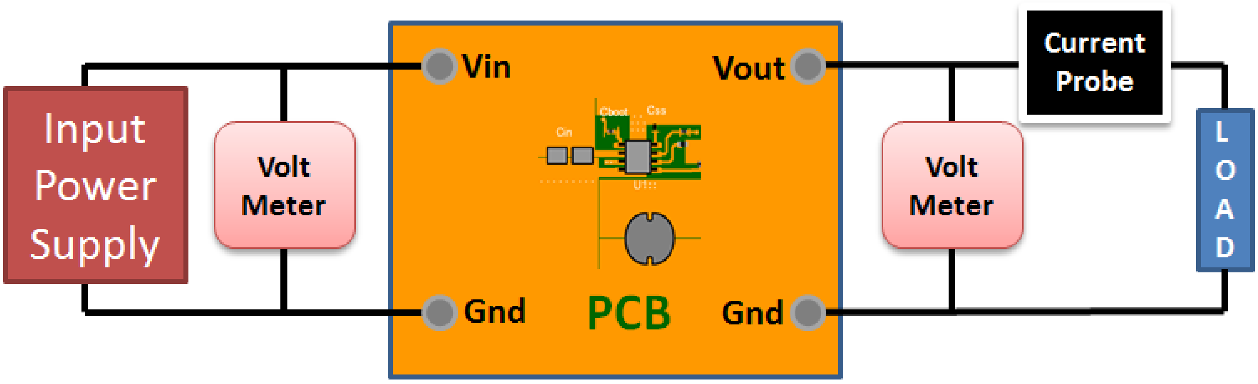
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town 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 11.5V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum Iout of the design from Vout 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 Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout 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 : 26DE43A500806E00[v1]

2. **TPS568215** Product Folder : http://www.ti.com/product/TPS568215 : contains the data sheet and other resources.

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