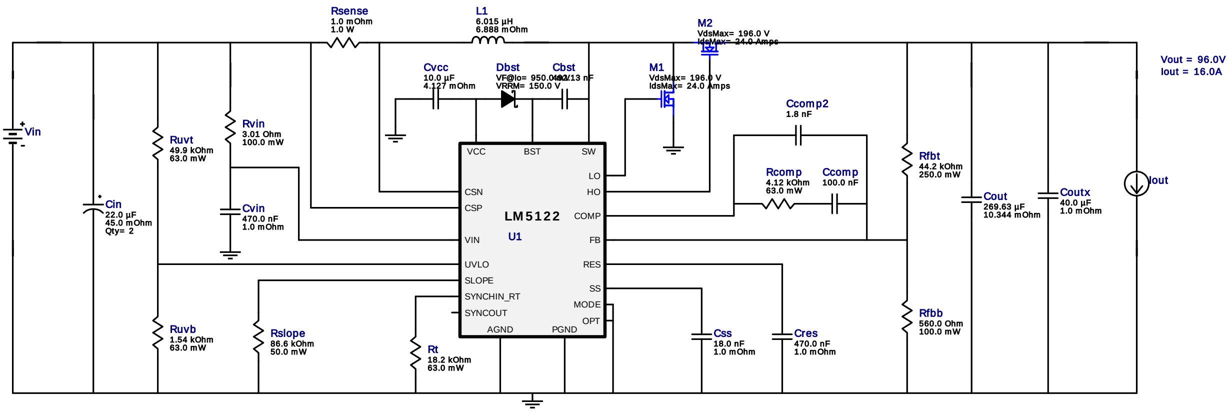
VinMin = 46.0V
VinMax = 50.0V
Vout = 96.0V
Iout = 16.0A

Device = LM5122MH/NOPB
Topology = Boost
Created = 2023-07-03 07:00:04.080
BOM Cost = NA
BOM Count = 25
Total Pd =

WEBENCH ® Design Report

Design : 37 LM5122MH/NOPB
LM5122MH/NOPB 46V-50V to 96.00V @ 16A



Design Alerts

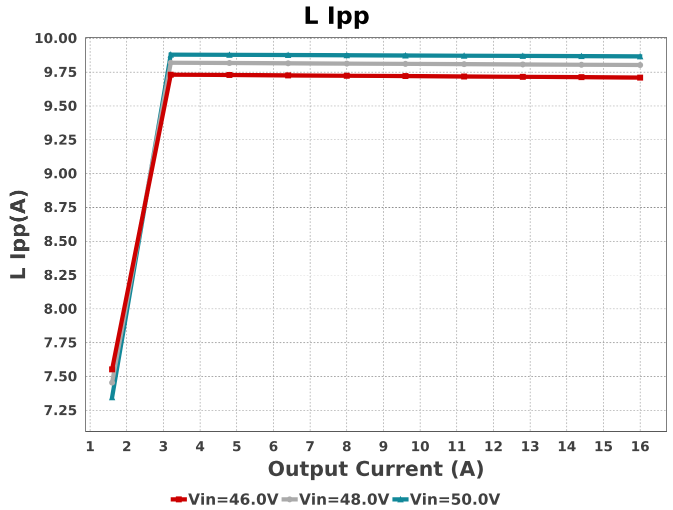
Component Selection Information

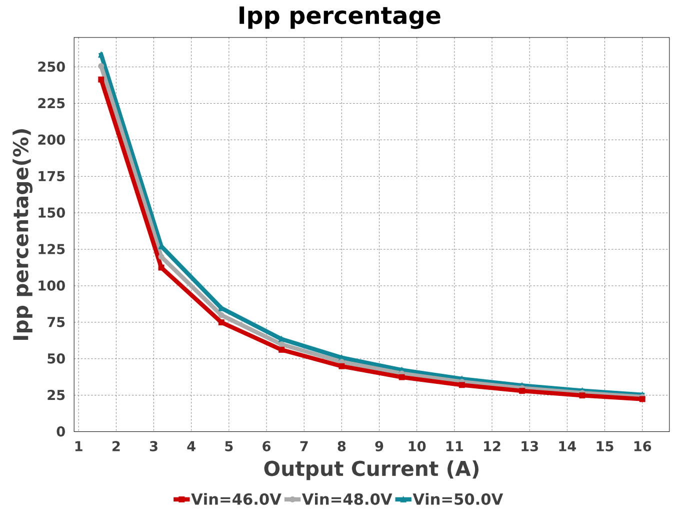
With the design conditions, either the IC or the selected FET junction temperature is exceeded above the maximum rating. Hence, this design is created using an ideal FET. Please note that the resulting FET parameters are ideal, so the efficiency/loss opvals have been disabled. Also, the schematic/PCB export and Thermal simulations will not work with the ideal FET.

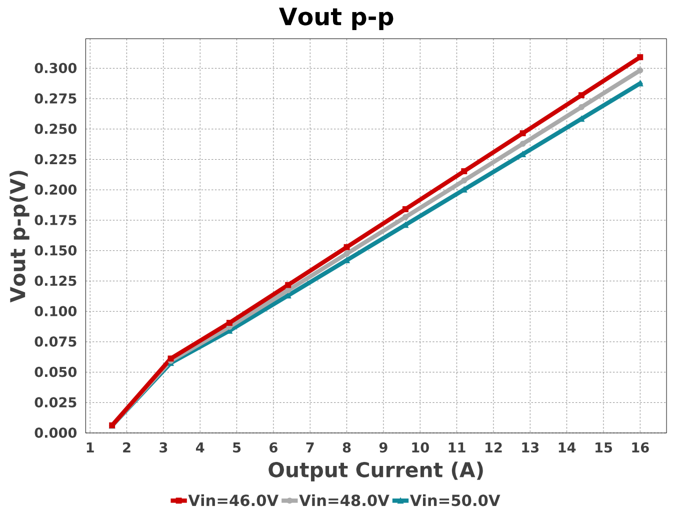
Electrical BOM

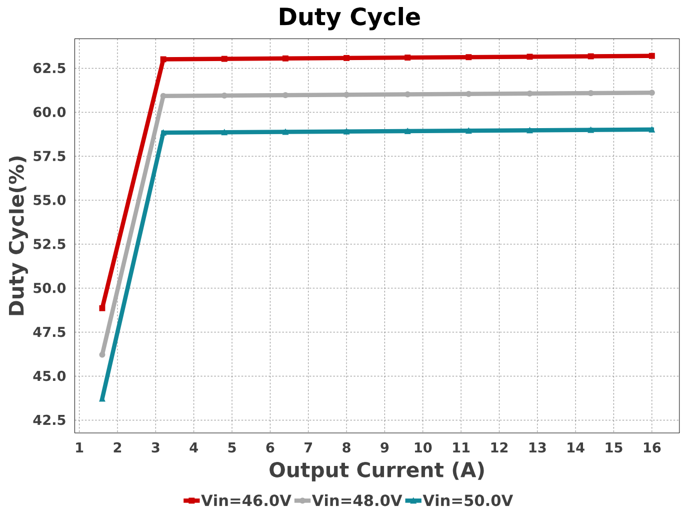
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	CUSTOM	CUSTOM Series= ?	Cap= 492.13 nF VDC= 115.2 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm^2
Ccomp	AVX	08053C104JAZ2A Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.07	0805 7 mm^2
Ccomp2	TDK	CGA4C2C0G1H182J060AA Series= C0G/NP0	Cap= 1.8 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
Cin	Panasonic	EEHZA1K220P Series= ZA	Cap= 22.0 uF ESR= 45.0 mOhm VDC= 80.0 V IRMS= 1.55 A	2	$1.31	SM_RADIAL_8MM 113 mm^2
Cout	CUSTOM	CUSTOM Series= ?	Cap= 269.63 uF ESR= 10.344 mOhm VDC= 111.0 V IRMS= 21.809 A	1	NA	CUSTOM 0 mm^2
Coutx	CUSTOM	CUSTOM Series= ?	Cap= 40.0 uF ESR= 1.0 mOhm VDC= 115.2 V IRMS= 1000.0 kA	1	NA	CUSTOM 0 mm^2
Cres	Taiyo Yuden	TMK212BJ474KD-T Series= X5R	Cap= 470.0 nF ESR= 1.0 mOhm VDC= 20.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm^2
Css	MuRata	GRM155R71C183KA01D Series= X7R	Cap= 18.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2

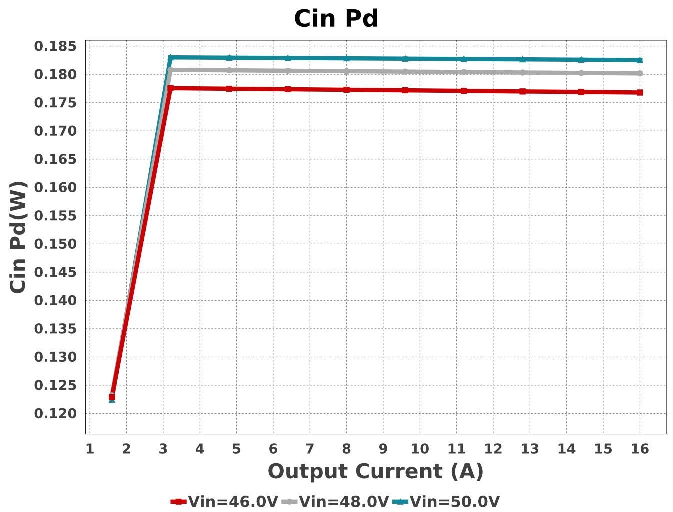
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cvcc	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	$0.03	0805 7 mm^2
Cvin	MuRata	GRM21BR72A474KA73L Series= X7R	Cap= 470.0 nF ESR= 1.0 mOhm VDC= 100.0 V IRMS= 0.0 A	1	$0.13	0805 7 mm^2
Dbst	SMC Diode Solutions	SK215ATR	VF@Io= 950.0 mV VRRM= 150.0 V	1	$0.06	SMA 37 mm^2
L1	CUSTOM	CUSTOM	L= 6.015 µH 6.888 mOhm	1	NA	CUSTOM 0 mm^2
M1	NA	IdealFET	VdsMax= 196.0 V IdsMax= 24.0 Amps	1	NA	KCS0003B 80 mm^2
M2	NA	IdealFET	VdsMax= 196.0 V IdsMax= 24.0 Amps	1	NA	KCS0003B 80 mm^2
Rcomp	Vishay-Dale	CRCW04024K12FKED Series= CRCW..e3	Res= 4.12 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbb	Yageo	RC0603FR-07560RL Series= ?	Res= 560.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rfbt	Vishay-Dale	CRCW120644K2FKEA Series= CRCW..e3	Res= 44.2 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm^2
Rsense	Rohm	PMR25HZPFV1L00 Series= PMR25	Res= 1.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.21	1210 15 mm^2
Rslope	Yageo	RC0201FR-0786K6L Series= ?	Res= 86.6 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
Rt	Vishay-Dale	CRCW040218K2FKED Series= CRCW..e3	Res= 18.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Ruvb	Vishay-Dale	CRCW04021K54FKED Series= CRCW..e3	Res= 1.54 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Ruvt	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rvin	Vishay-Dale	CRCW06033R01FKEA Series= CRCW..e3	Res= 3.01 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
U1	Texas Instruments	LM5122MH/NOPB	Switcher	1	$2.09	MXA20A 71 mm^2

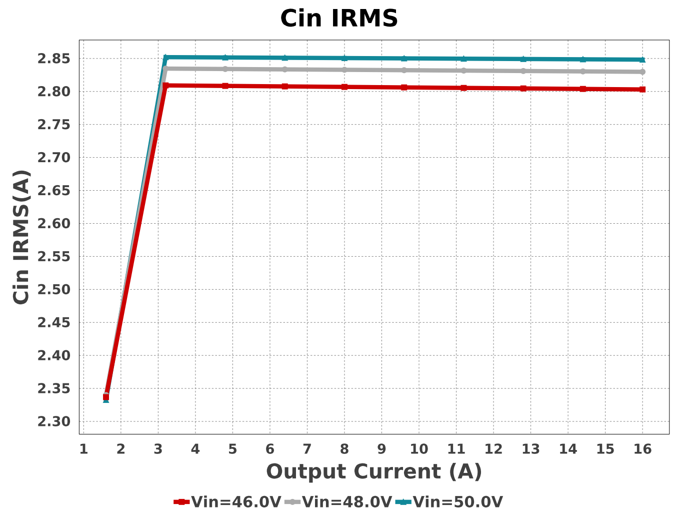

L Ipp
L Ipp(A)
Output Current (A)
Vin=46.0V
Vin=48.0V
Vin=50.0V

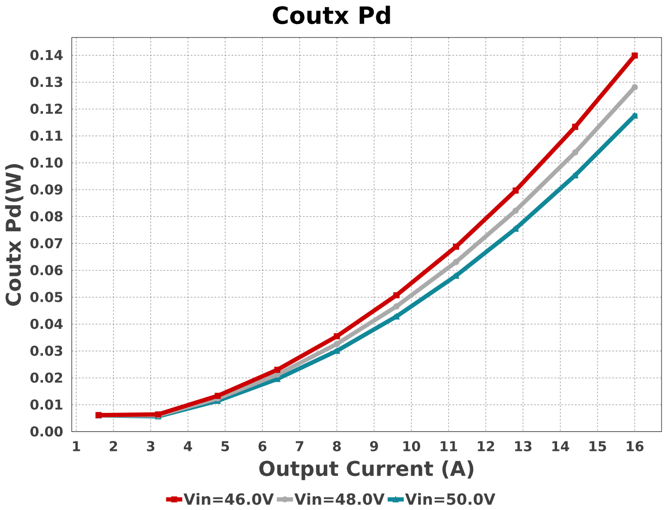

Ipp percentage
Ipp percentage(%)
Output Current (A)
Vin=46.0V
Vin=48.0V
Vin=50.0V

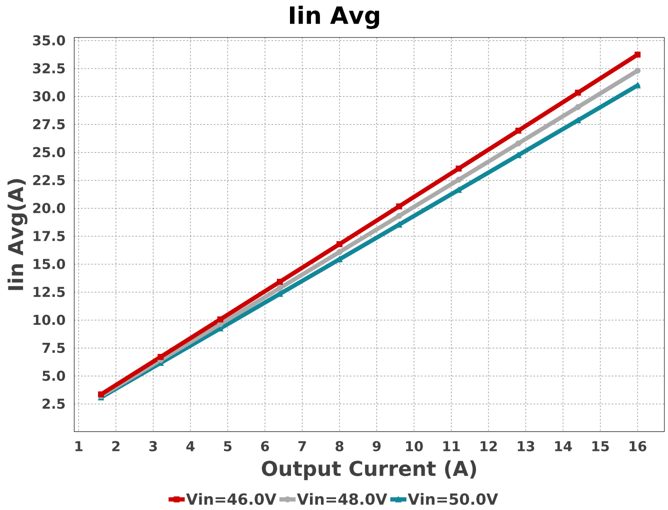

Vout p-p
Vout p-p(V)
Output Current (A)
Vin=46.0V
Vin=48.0V
Vin=50.0V

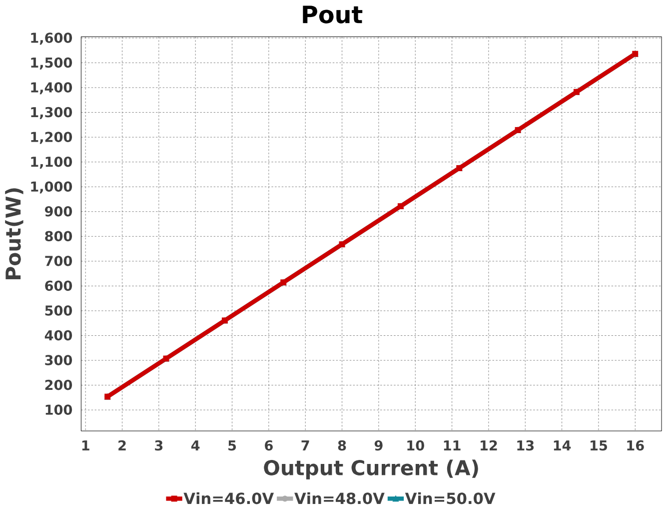

Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=46.0V
Vin=48.0V
Vin=50.0V

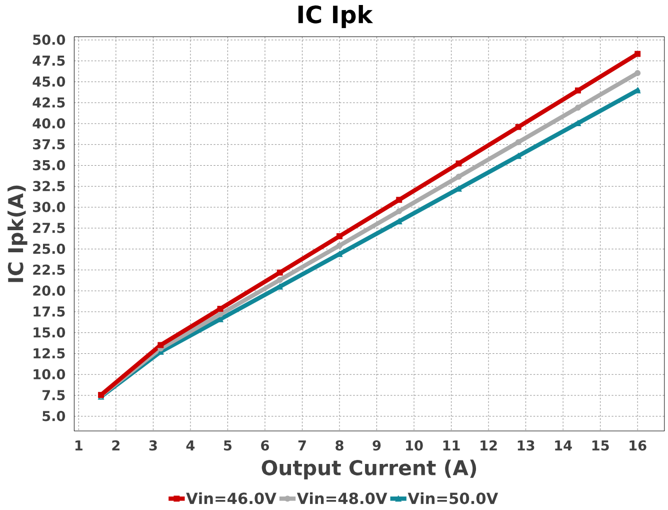

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=46.0V
Vin=48.0V
Vin=50.0V

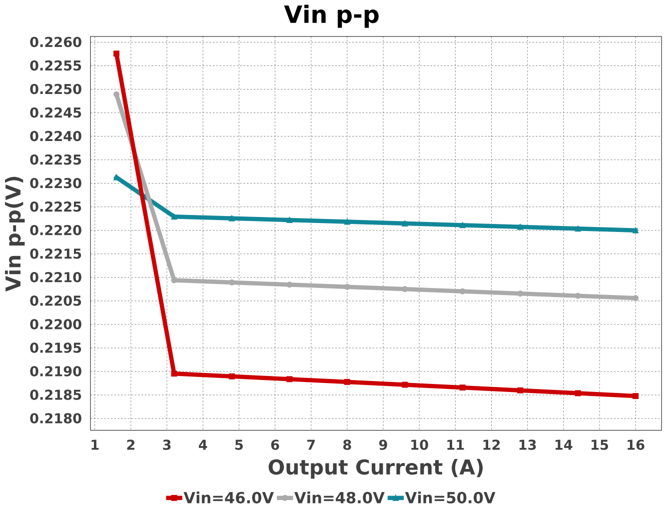

Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin=46.0V
Vin=48.0V
Vin=50.0V

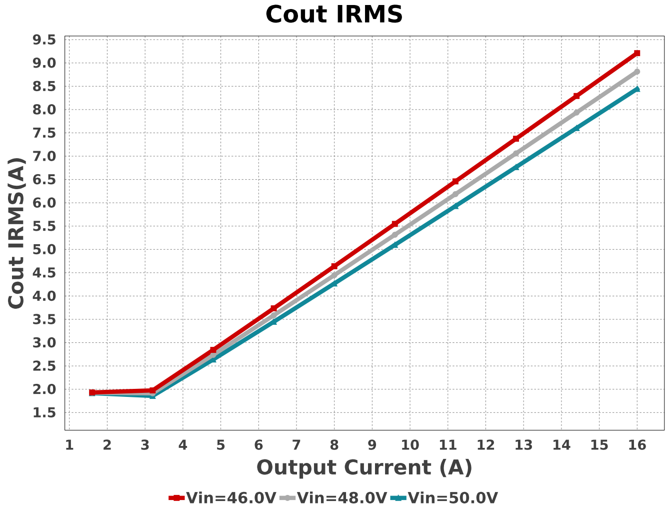

Coutx Pd
Coutx Pd(W)
Output Current (A)
Vin=46.0V Vin=48.0V Vin=50.0V

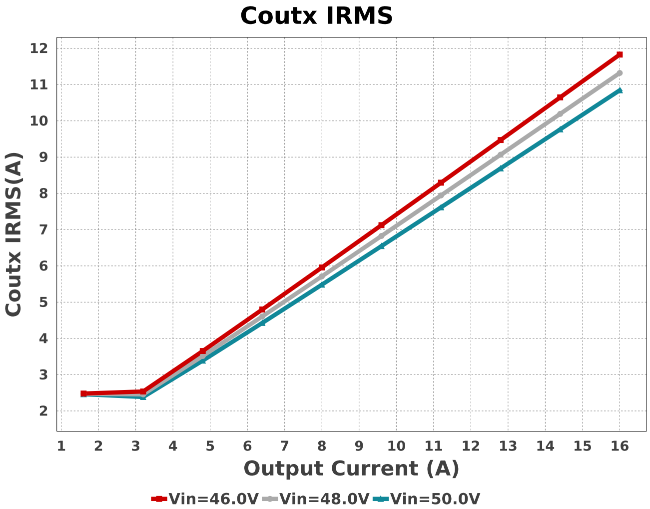

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=46.0V Vin=48.0V Vin=50.0V

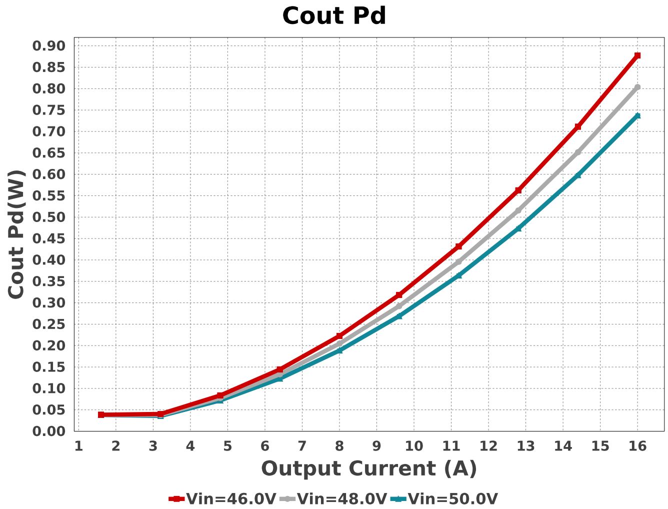

Pout
Pout(W)
Output Current (A)
Vin=46.0V Vin=48.0V Vin=50.0V

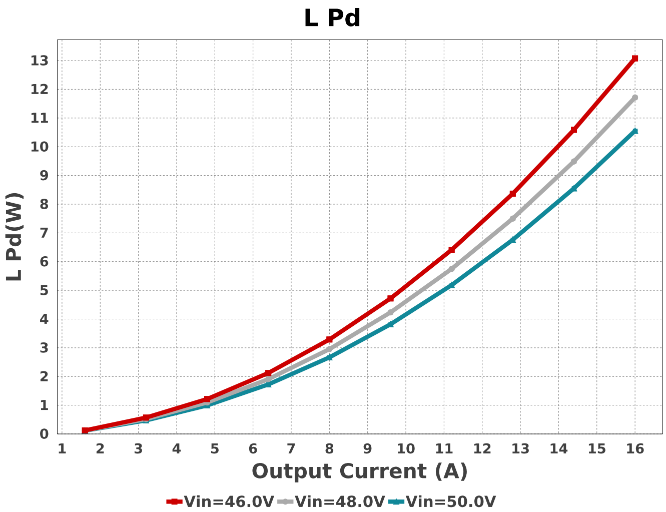

IC Ipk
IC Ipk(A)
Output Current (A)
Vin=46.0V Vin=48.0V Vin=50.0V

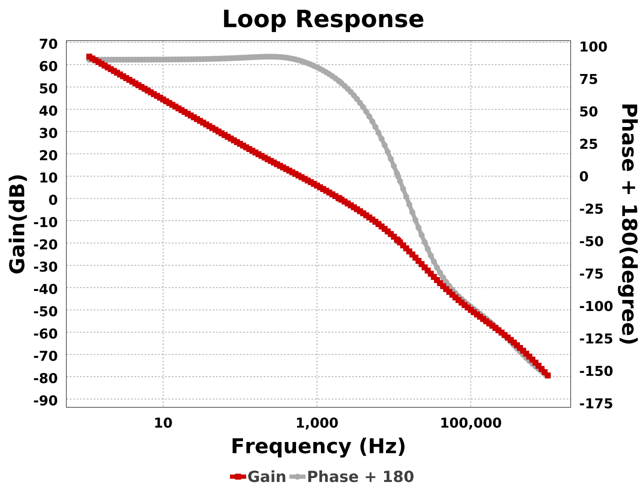

Vin p-p
Vin p-p(V)
Output Current (A)
Vin=46.0V Vin=48.0V Vin=50.0V


Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=46.0V Vin=48.0V Vin=50.0V









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.803 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	176.79 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	9.21 A	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	877.45 mW	Capacitor	Output capacitor power dissipation
5.	Coutx IRMS	11.828 A	Capacitor	Output capacitor_x RMS ripple current
6.	Coutx Pd	139.9 mW	Capacitor	Output capacitor_x power loss
7.	IC Ipk	48.337 A	IC	Peak switch current in IC
8.	IC Tolerance	18.0 mV	IC	IC Feedback Tolerance
9.	Iin Avg	33.749 A	IC	Average input current
10.	Ipp percentage	22.331 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
11.	L Ipp	9.71 A	Inductor	Peak-to-peak inductor ripple current
12.	L Pd	13.077 W	Inductor	Inductor power dissipation
13.	Cin Pd	176.79 mW	Power	Input capacitor power dissipation
14.	Cout Pd	877.45 mW	Power	Output capacitor power dissipation
15.	Coutx Pd	139.9 mW	Power	Output capacitor_x power loss
16.	L Pd	13.077 W	Power	Inductor power dissipation
17.	BOM Count	25	System Information	Total Design BOM count
18.	Cross Freq	1.772 kHz	System Information	Bode plot crossover frequency
19.	Duty Cycle	63.203 %	System Information	Duty cycle
20.	FootPrint	1.465 k mm^2	System Information	Total Foot Print Area of BOM components
21.	Frequency	494.505 kHz	System Information	Switching frequency
22.	Gain Marg	-18.656 dB	System Information	Bode Plot Gain Margin
23.	Iout	16.0 A	System Information	Iout operating point

#	Name	Value	Category	Description
24.	Low Freq Gain	64.207 dB	System Information	Gain at 1Hz
25.	Mode	CCM	System Information	Conduction Mode
26.	Phase Marg	72.894 deg	System Information	Bode Plot Phase Margin
27.	Pout	1.536 kW	System Information	Total output power
28.	Total BOM	NA	System Information	Total BOM Cost
29.	Vin	46.0 V	System Information	Vin operating point
30.	Vin p-p	218.478 mV	System Information	Peak-to-peak input voltage
31.	Vout	96.0 V	System Information	Operational Output Voltage
32.	Vout Actual	95.914 V	System Information	Vout Actual calculated based on selected voltage divider resistors
33.	Vout Tolerance	3.525 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
34.	Vout p-p	309.147 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	16.0	Maximum Output Current
VinMax	50.0	Maximum input voltage
VinMin	46.0	Minimum input voltage
Vout	96.0	Output Voltage
base_pn	LM5122	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 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

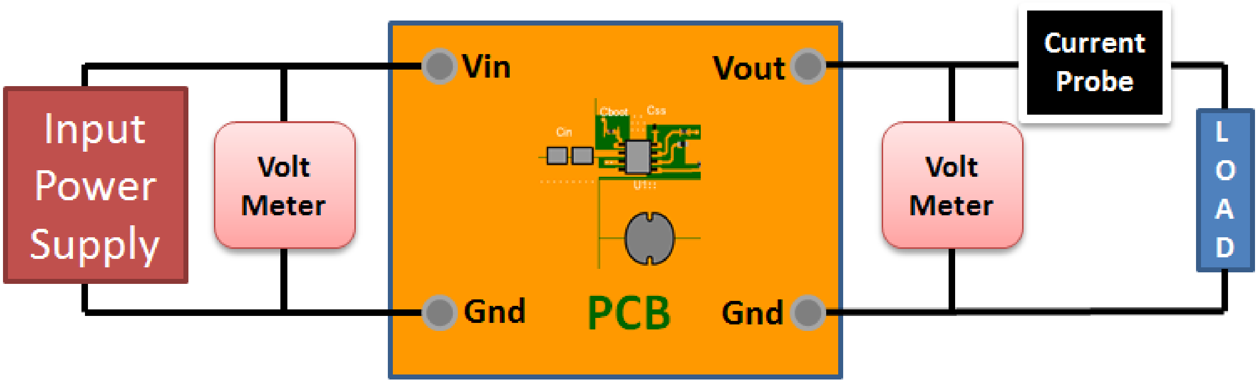
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 46.0V 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. The LM5122 is a wide range boost controller which is operable in an ultra wide input range of 4.5 to 65V. A boost regulator can maintain regulation for input voltages lower than the output voltage.

2. Master key : 45DBC70A3D478A43[v1]

3. **LM5122** Product Folder : http://www.ti.com/product/LM5122 : contains the data sheet and other resources.