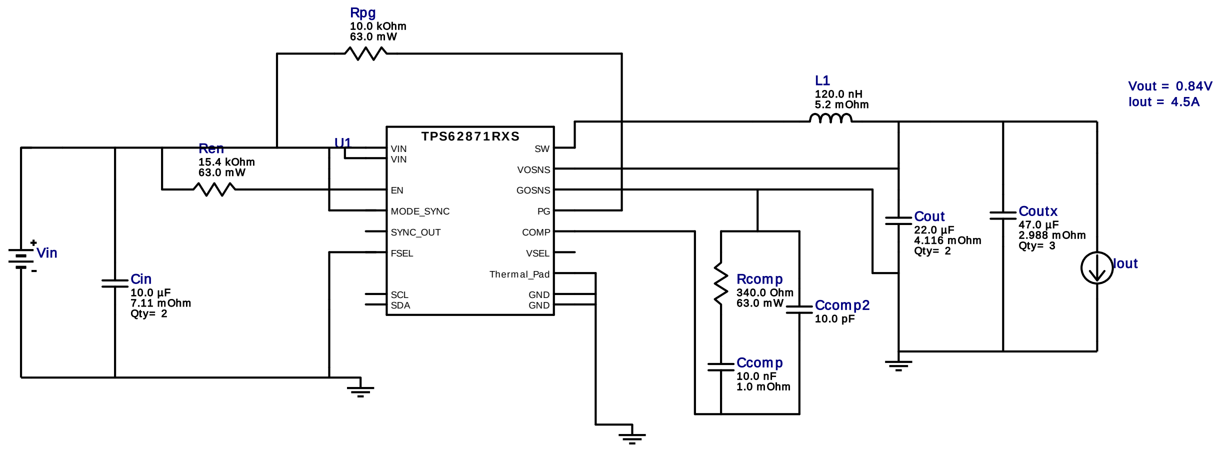
TEXAS INSTRUMENTS

WEBENCH ® Design Report

VinMin = 3.14V
VinMax = 3.47V
Vout = 0.84V
Iout = 4.5A

Device = TPS62871Z0WRXSR
Topology = Buck
Created = 2025-11-09 23:28:26.091
BOM Cost = $2.59
BOM Count = 14
Total Pd = 0.41W

Design : 15591 TPS62871Z0WRXSR
TPS62871Z0WRXSR 3.14V-3.47V to .84V @ 4.5A

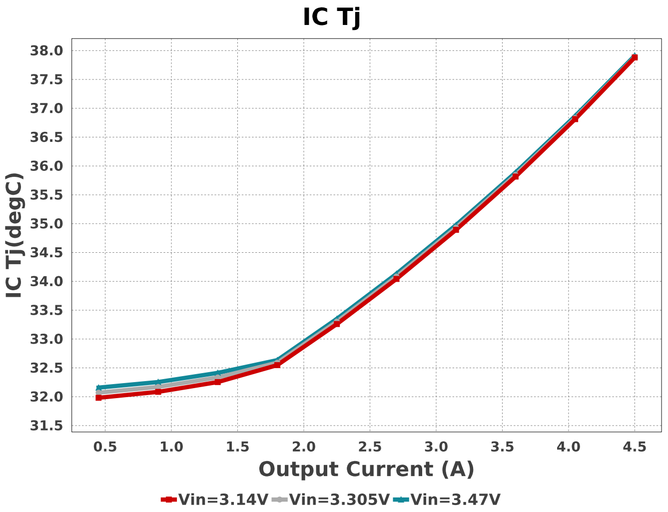


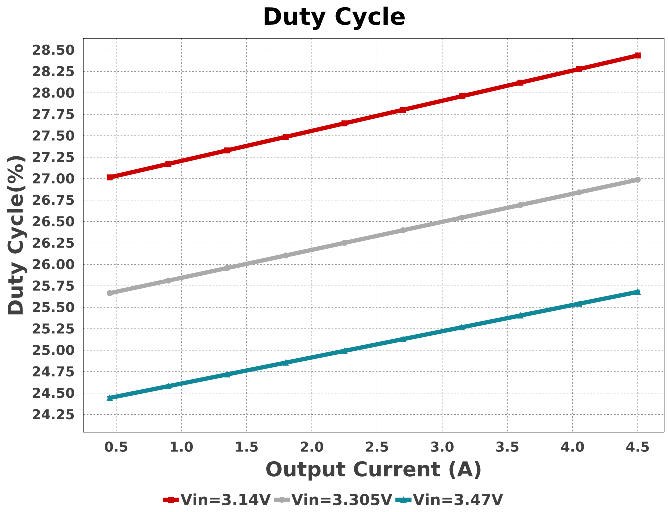
1. Note1: The design can now be updated for Adjustable Vout by clicking on the change option of the 'Update Design' window.
2. Note2: Please refer to datasheet for proper VSEL configuration .

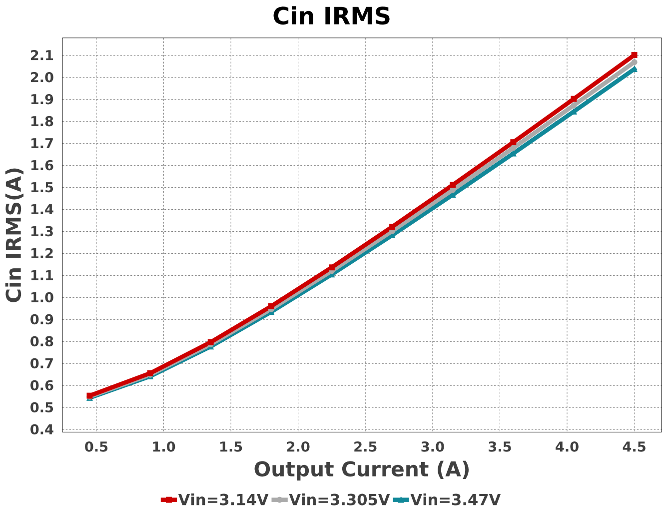
Electrical BOM

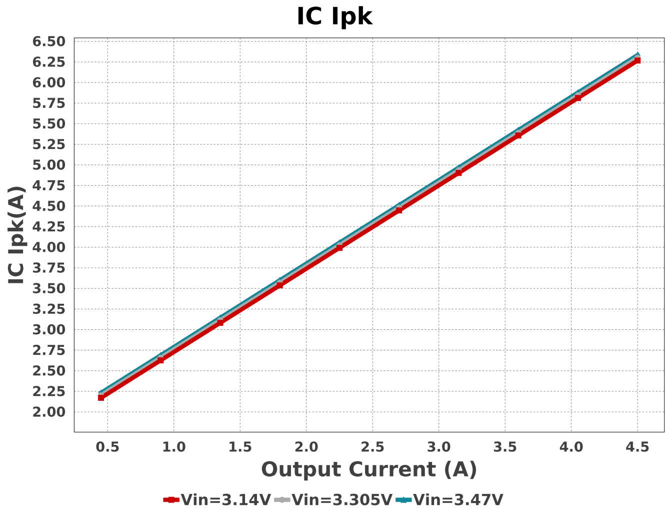
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Ccomp	MuRata	GRM155R70J103KA01D Series= X7R	Cap= 10.0 nF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
Ccomp2	Kemet	C0402C100J3GACTU Series= C0G/NP0	Cap= 10.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
Cin	Taiyo Yuden	MSASJ219JB5106KTNA01 Series= X5R	Cap= 10.0 uF ESR= 7.11 mOhm VDC= 6.3 V IRMS= 2.7429 A	2	$0.03	0805 7 mm²
Cout	Taiyo Yuden	MCASA21GAB5226MTNA01 Series= X5R	Cap= 22.0 uF ESR= 4.116 mOhm VDC= 4.0 V IRMS= 3.70158 A	2	$0.06	0805 7 mm²
Coutx	Taiyo Yuden	MSASJ21GBB5476MTNA01 Series= X5R	Cap= 47.0 uF ESR= 2.988 mOhm VDC= 6.3 V IRMS= 3.5841 A	3	$0.09	0805 7 mm²
L1	Coilcraft	XFL4012-121MEB	L= 120.0 nH 5.2 mOhm	1	$0.53	XFL4012 28 mm²
Rcomp	Vishay-Dale	CRCW0402340RFKED Series= CRCW..e3	Res= 340.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Ren	Yageo	AC0402FR-0715K4L Series= ?	Res= 15.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rpg	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

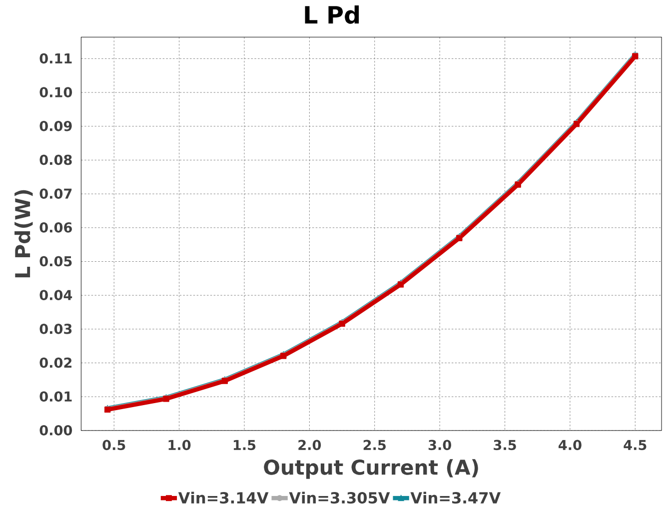
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
U1	Texas Instruments	TPS62871Z0WRXSR	Switcher	1	$1.56	RXS0016A-MFG 23 mm²

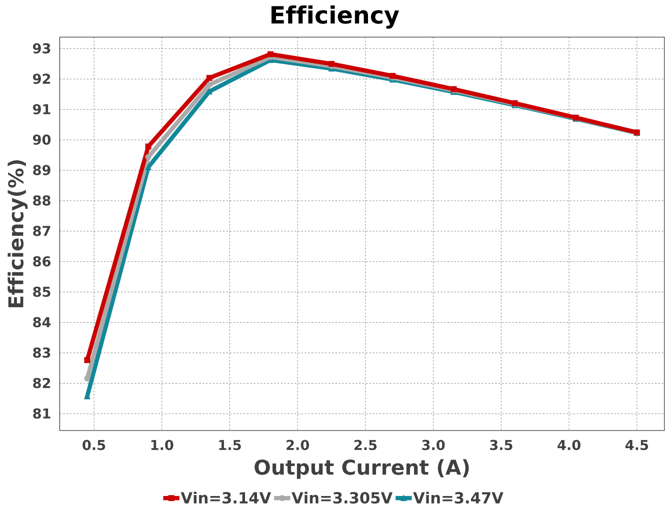




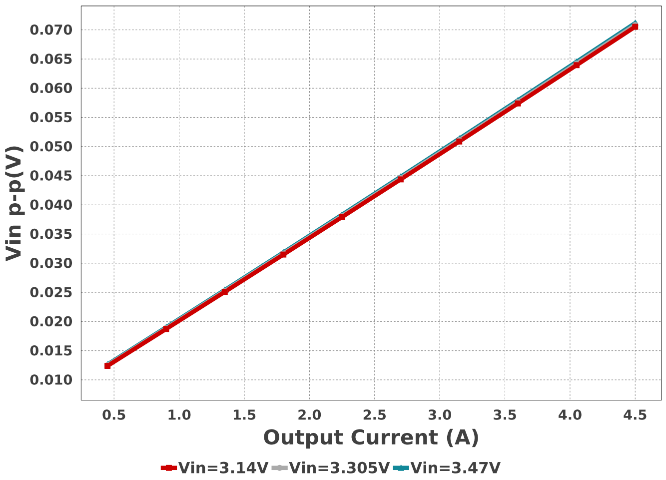




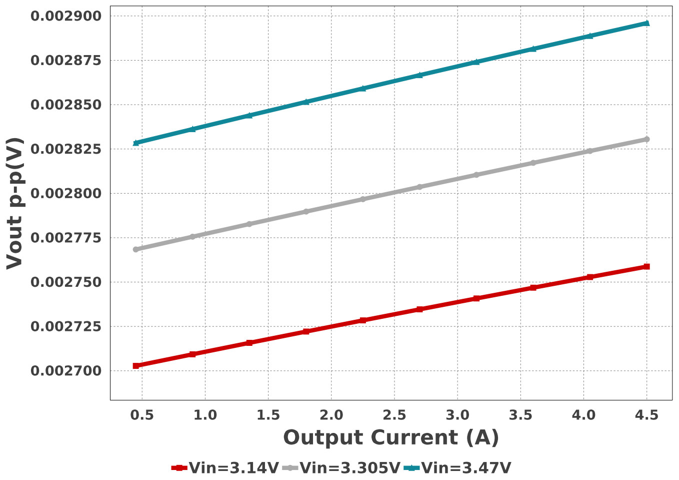




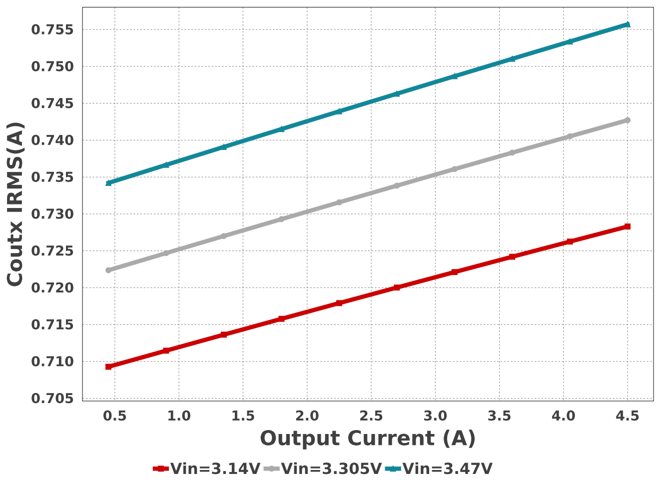
Vin p-p



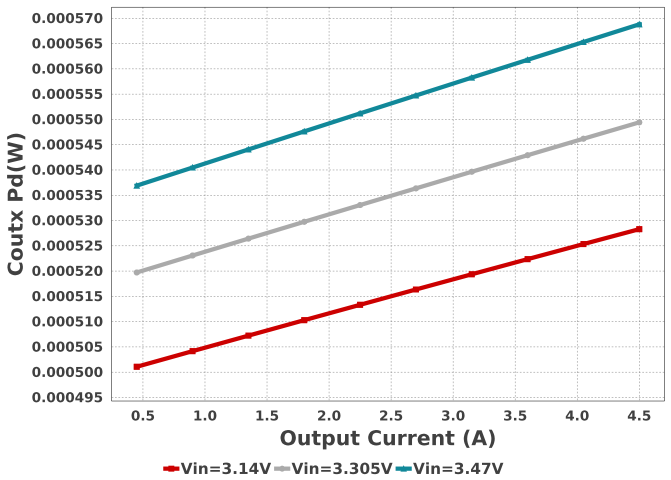
Vout p-p



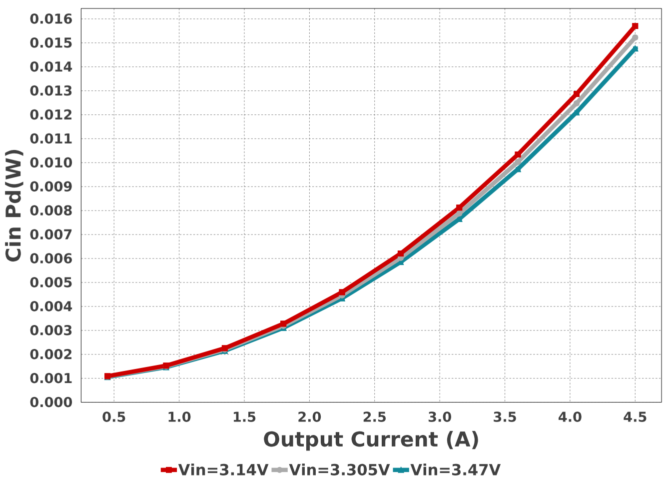
Coutx IRMS



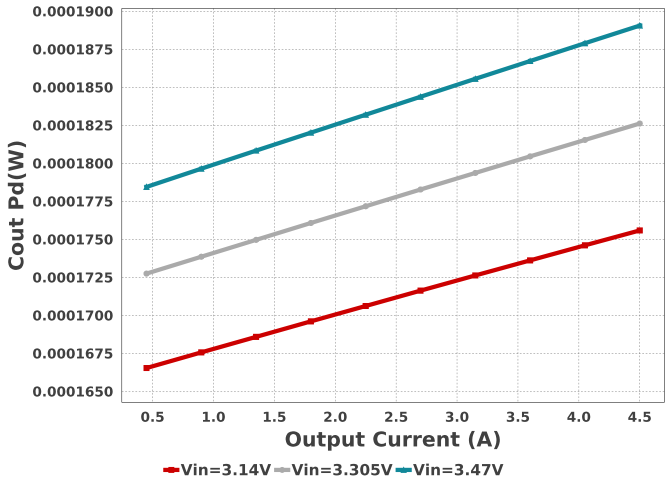
Coutx Pd

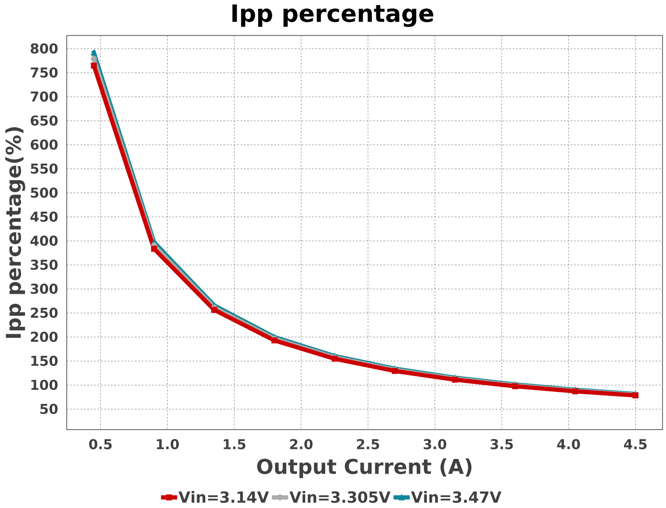


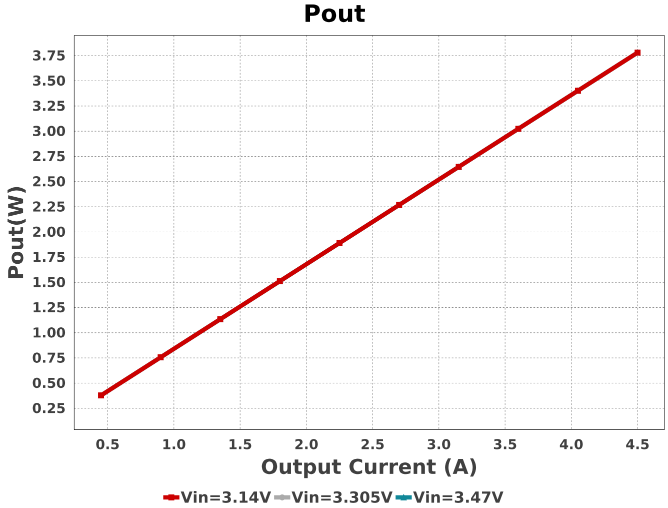
Cin Pd

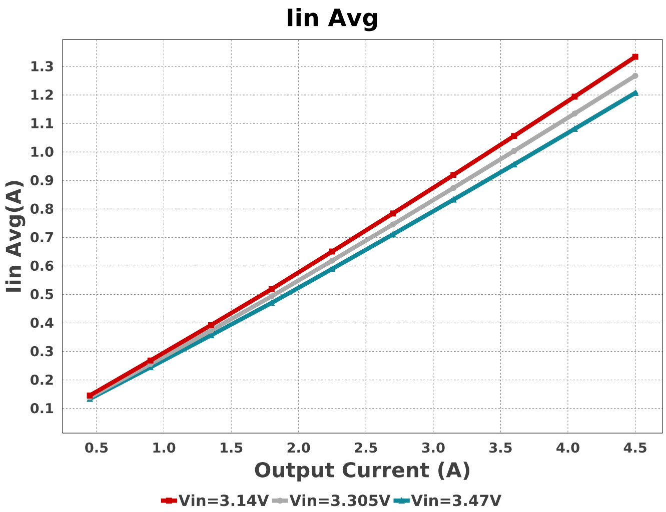


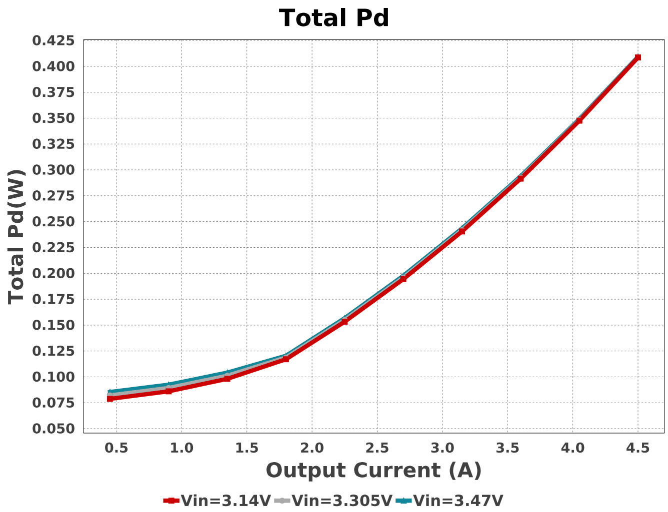
Cout Pd

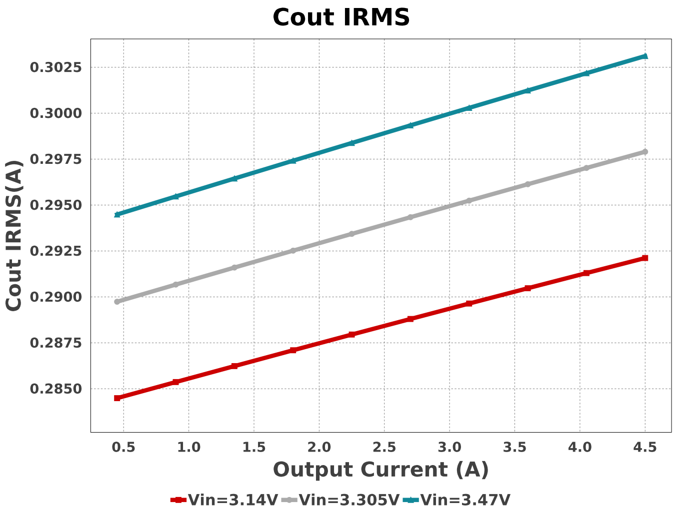


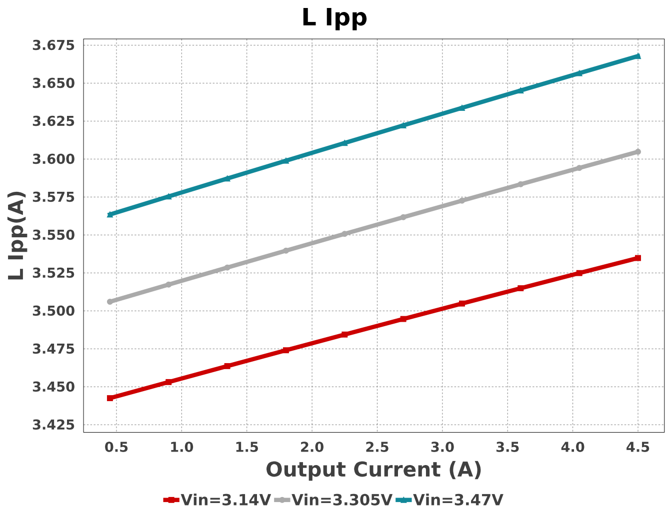

Ipp percentage
Ipp percentage(%)
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=3.14V
Vin=3.305V
Vin=3.47V

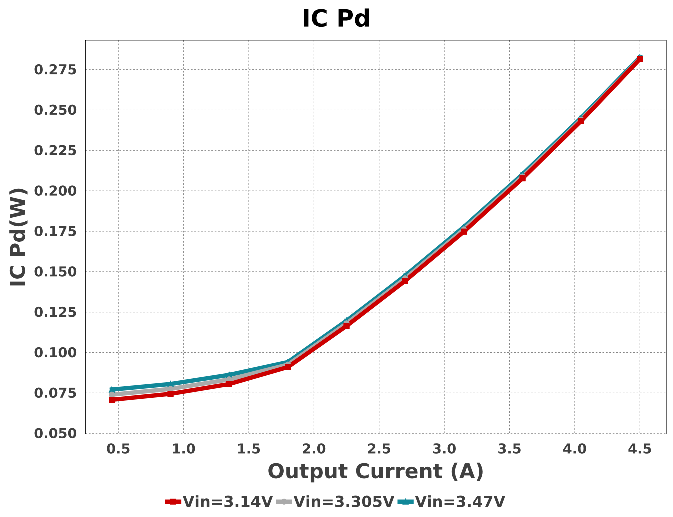

Pout
Pout(W)
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=3.14V
Vin=3.305V
Vin=3.47V

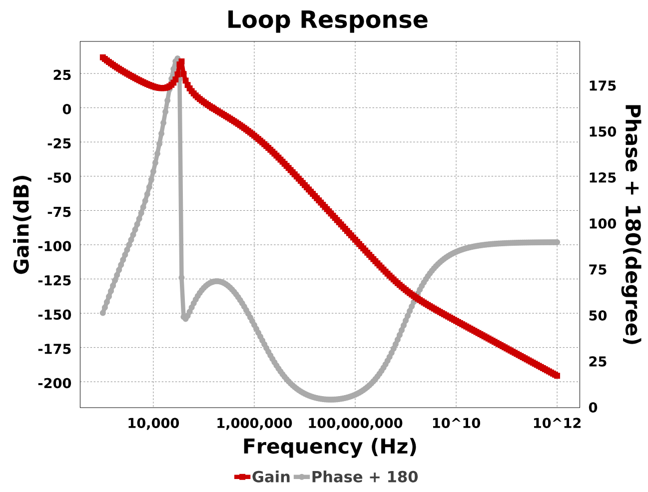

Iin Avg
Iin Avg(A)
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=3.14V
Vin=3.305V
Vin=3.47V


Total Pd
Total Pd(W)
0.425
0.400
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=3.14V
Vin=3.305V
Vin=3.47V


Cout IRMS
Cout IRMS(A)
0.3025
0.3000
0.2975
0.2950
0.2925
0.2900
0.2875
0.2850
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=3.14V
Vin=3.305V
Vin=3.47V


L Ipp
L Ipp(A)
3.675
3.650
3.625
3.600
3.575
3.550
3.525
3.500
3.475
3.450
3.425
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=3.14V
Vin=3.305V
Vin=3.47V





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.038 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	14.763 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	303.111 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	189.08 µW	Capacitor	Output capacitor power dissipation
5.	Coutx IRMS	755.706 mA	Capacitor	Output capacitor_x RMS ripple current
6.	Coutx Pd	568.81 µW	Capacitor	Output capacitor_x power loss
7.	IC Ipk	6.334 A	IC	Peak switch current in IC
8.	IC Pd	282.58 mW	IC	IC power dissipation
9.	IC Tj	37.912 degC	IC	IC junction temperature
10.	ICThetaJA Effective	28.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
11.	Iin Avg	1.207 A	IC	Average input current
12.	Ipp percentage	81.508 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
13.	L Ipp	3.668 A	Inductor	Peak-to-peak inductor ripple current
14.	L Pd	111.13 mW	Inductor	Inductor power dissipation
15.	Cin Pd	14.763 mW	Power	Input capacitor power dissipation
16.	Cout Pd	189.08 µW	Power	Output capacitor power dissipation
17.	Coutx Pd	568.81 µW	Power	Output capacitor_x power loss
18.	IC Pd	282.58 mW	Power	IC power dissipation
19.	L Pd	111.13 mW	Power	Inductor power dissipation
20.	Total Pd	409.256 mW	Power	Total Power Dissipation
21.	BOM Count	14	System Information	Total Design BOM count
22.	Cross Freq	147.575 kHz	System Information	Bode plot crossover frequency
23.	Duty Cycle	25.68 %	System Information	Duty cycle
24.	Efficiency	90.231 %	System Information	Steady state efficiency
25.	FootPrint	113.0 mm^2	System Information	Total Foot Print Area of BOM components
26.	Frequency	1.5 MHz	System Information	Switching frequency
27.	Gain Marg	-259.468 dB	System Information	Bode Plot Gain Margin
28.	Iout	4.5 A	System Information	Iout operating point
29.	Low Freq Gain	36.795 dB	System Information	Gain at 1Hz
30.	Mode	CCM	System Information	Conduction Mode
31.	Phase Marg	68.346 deg	System Information	Bode Plot Phase Margin
32.	Pout	3.78 W	System Information	Total output power
33.	Total BOM	$2.59	System Information	Total BOM Cost
34.	Vin	3.47 V	System Information	Vin operating point
35.	Vin p-p	71.162 mV	System Information	Peak-to-peak input voltage

#	Name	Value	Category	Description
36.	Vout	840.0 mV	System Information	Operational Output Voltage
37.	Vout Tolerance	1.0 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
38.	Vout p-p	2.896 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	4.5	Maximum Output Current
VinMax	3.47	Maximum input voltage
VinMin	3.14	Minimum input voltage
Vout	840.0 m	Output Voltage
base_pn	TPS62871	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

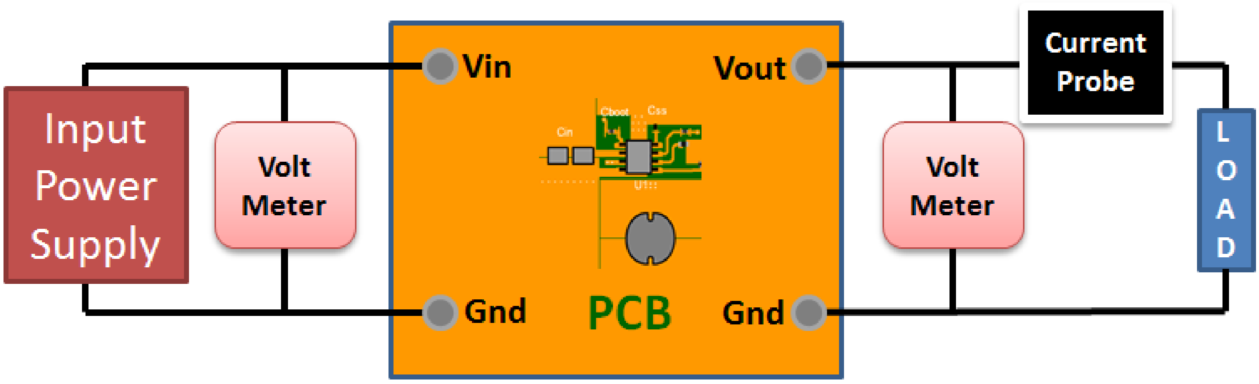
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 3.14V 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 : 9323268074580801[v1]

2. **TPS62871** Product Folder : http://www.ti.com/product/TPS62871 : contains the data sheet and other resources.

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