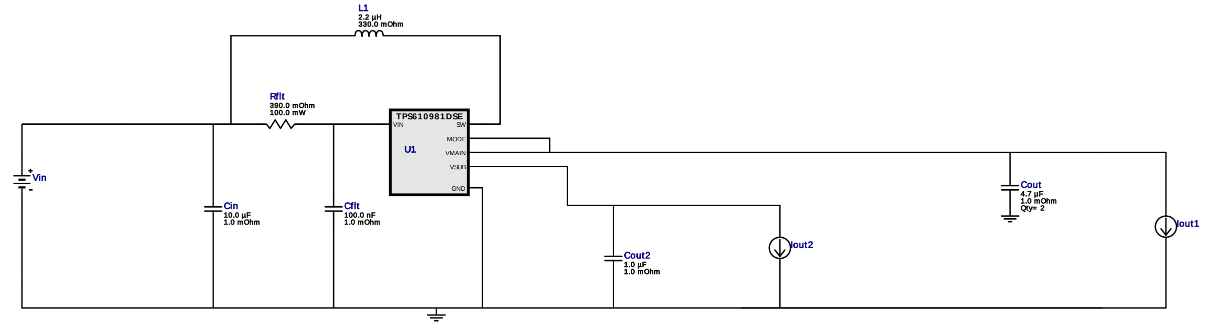
WEBENCH® Design Report

VinMin = 2.4V
VinMax = 3.3V
Vout = 3.3V
Iout = 0.15A

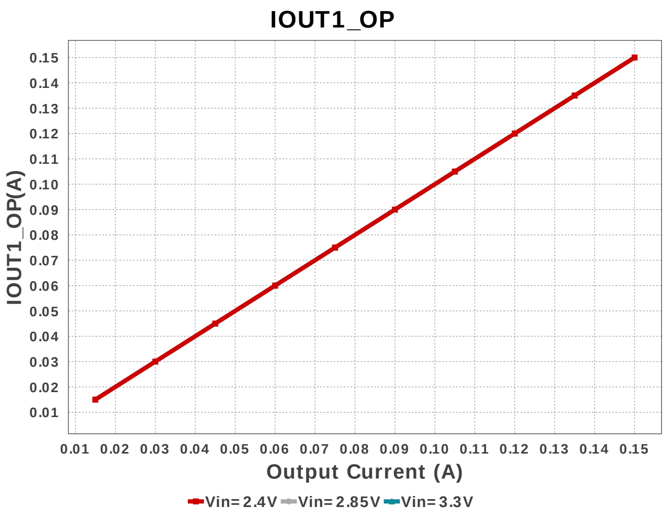
Device = TPS610981DSER
Topology = Boost_PassThrough
Created = 2021-06-07 14:19:09.047
BOM Cost = $0.66
BOM Count = 8
Total Pd = 0.05W

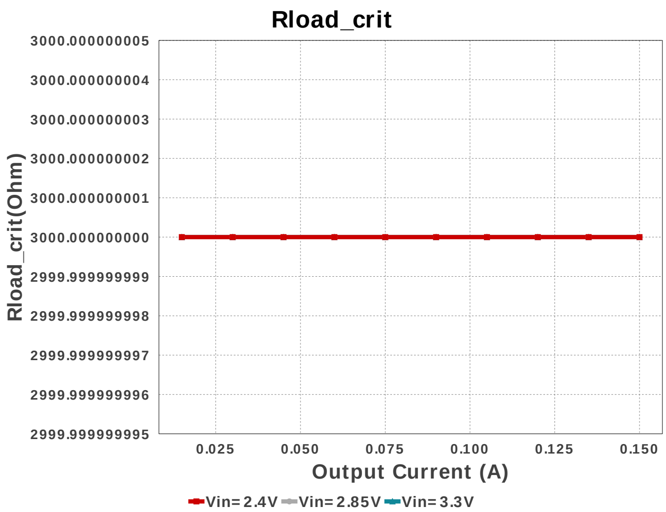
Design : 2 TPS610981DSER
TPS610981DSER 2.4V-3.3V to 3.30V @ 0.15A

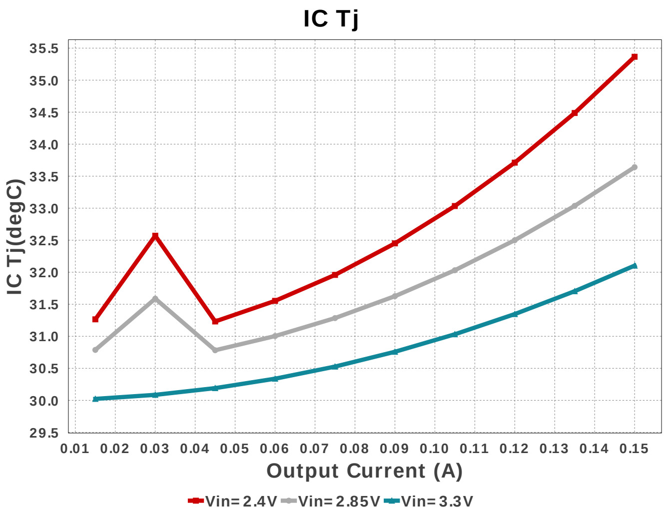


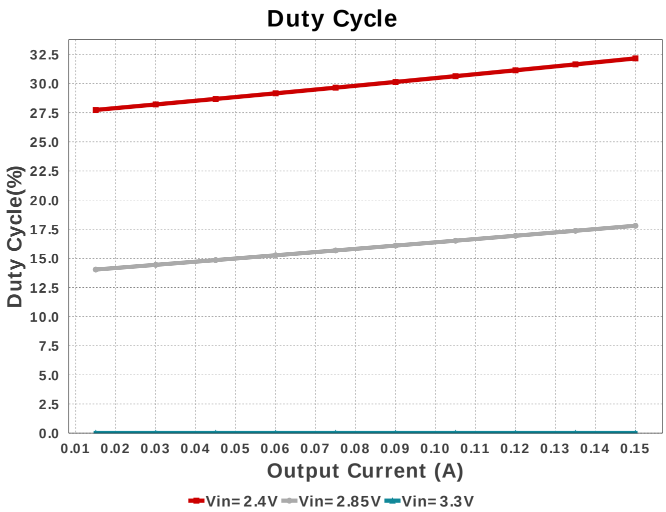
Electrical BOM

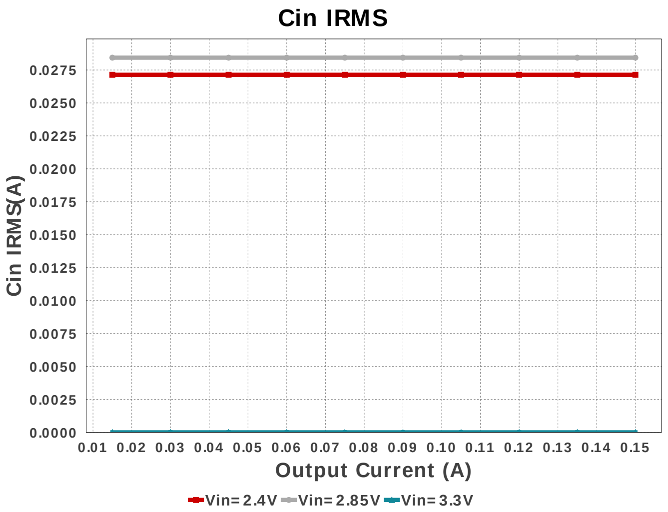
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cflt	MuRata	GRM155R70J104KA01D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
Cin	MuRata	GRJ155R60J106ME11D Series= X5R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.02	0402_070 3 mm^2
Cout	MuRata	GRM155R61A475MEAAD Series= X5R	Cap= 4.7 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	2	$0.03	0402_065 3 mm^2
Cout2	Kemet	C0603C105K8PACTU Series= X5R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
L1	Taiyo Yuden	CBC2012T2R2M	L= 2.2 µH 330.0 mOhm	1	$0.08	CBC2012 8 mm^2
Rflt	Panasonic	ERJ-3RQFR39V Series= ERJ-3R	Res= 390.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.02	0603 5 mm^2
U1	Texas Instruments	TPS610981DSER	Switcher	1	$0.46	DSE0006A 6 mm^2

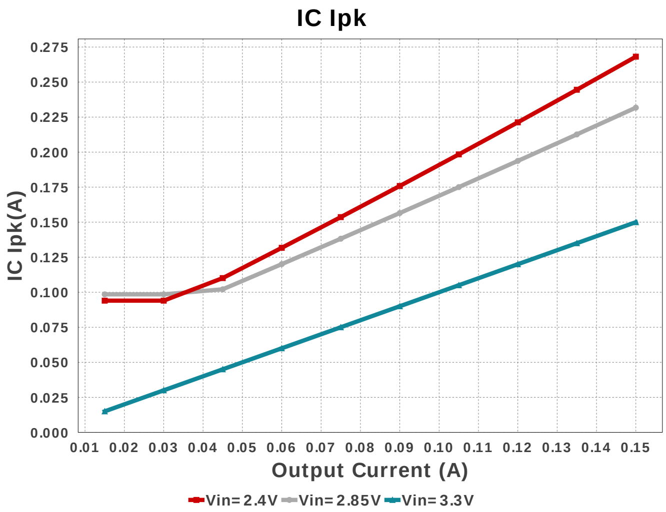

IOUT1_OP
IOUT1_OP(A)
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V


Rload_crit
Rload_crit(Ohm)
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V

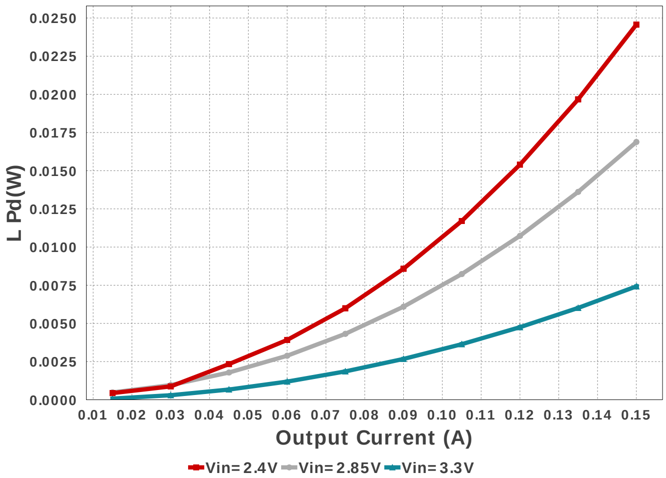

IC Tj
IC Tj(degC)
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V


Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V

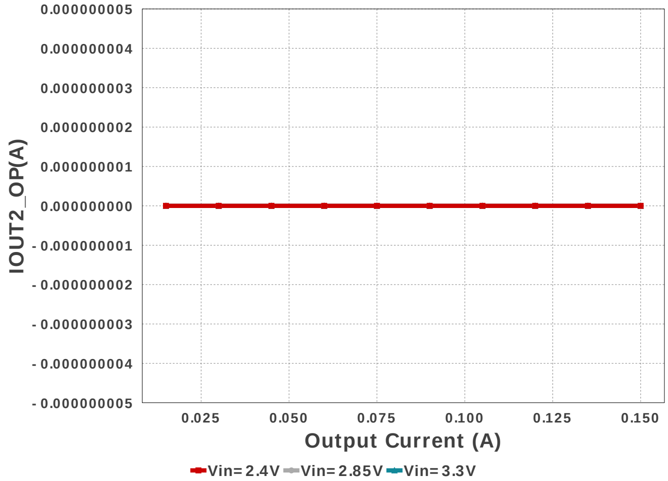

Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V


IC Ipk
IC Ipk(A)
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V

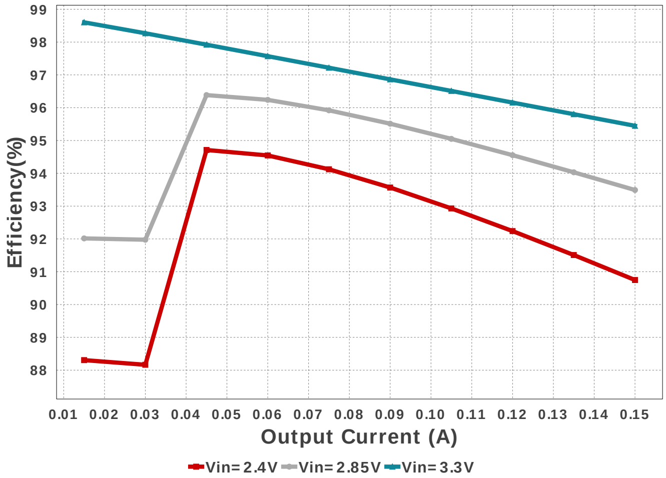
L Pd



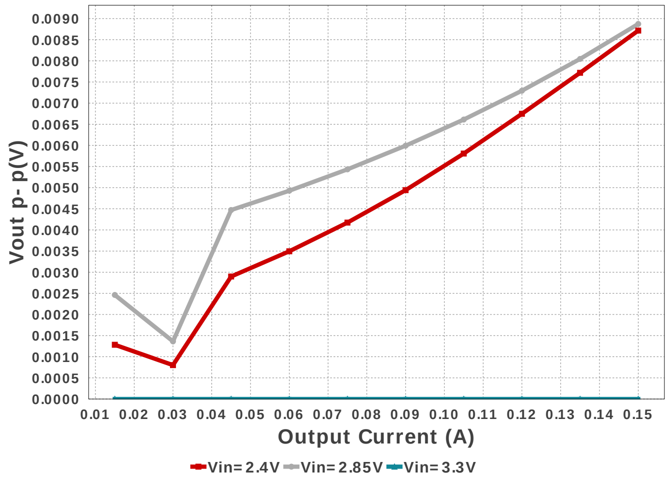
IOUT2_OP



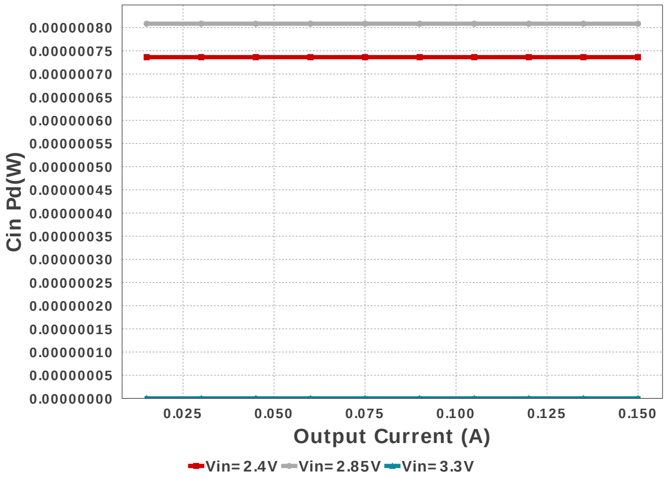
Efficiency



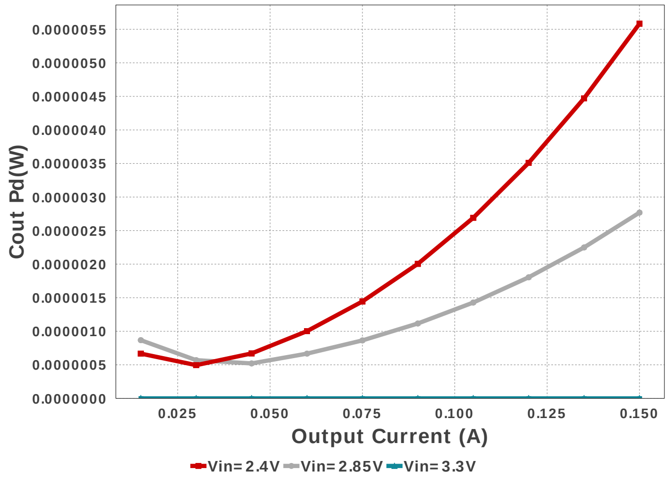
Vout p-p

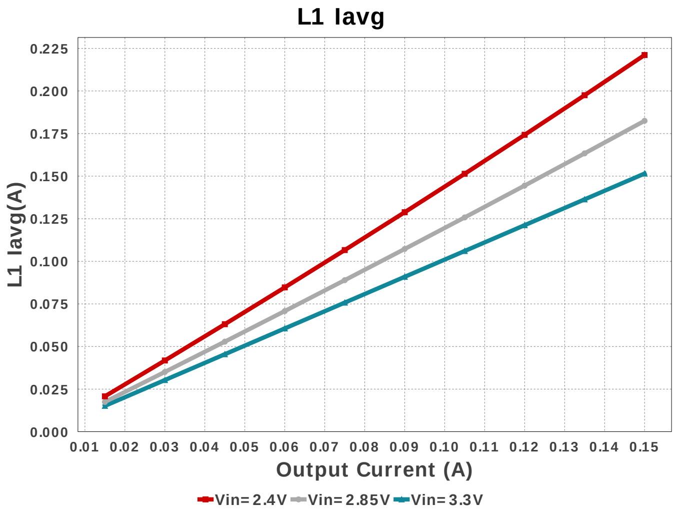


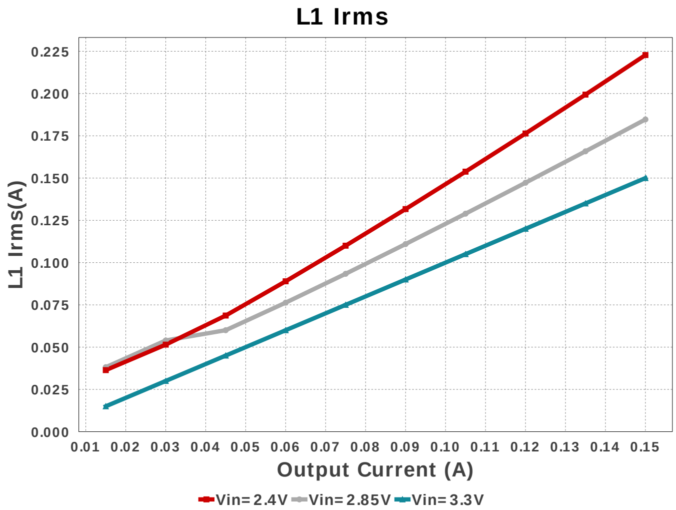
Cin Pd

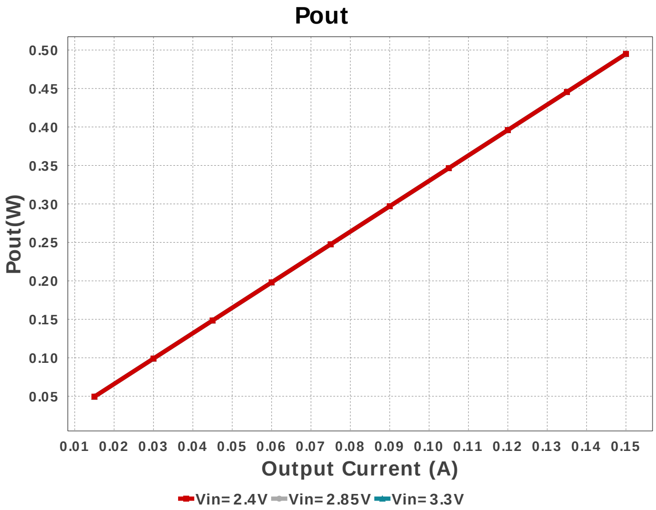


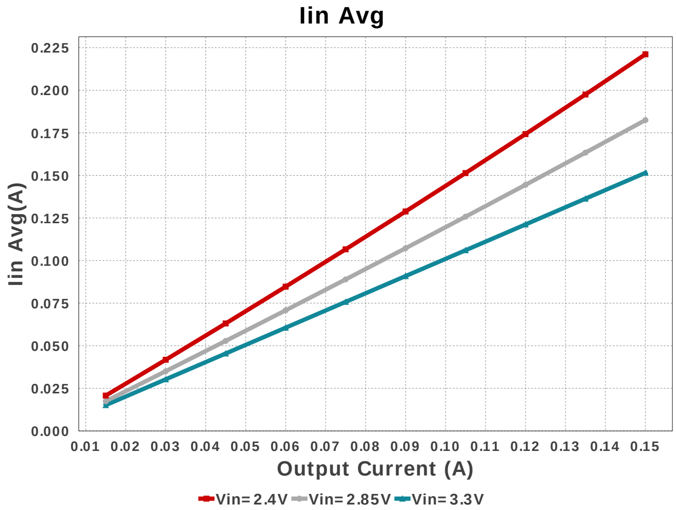
Cout Pd

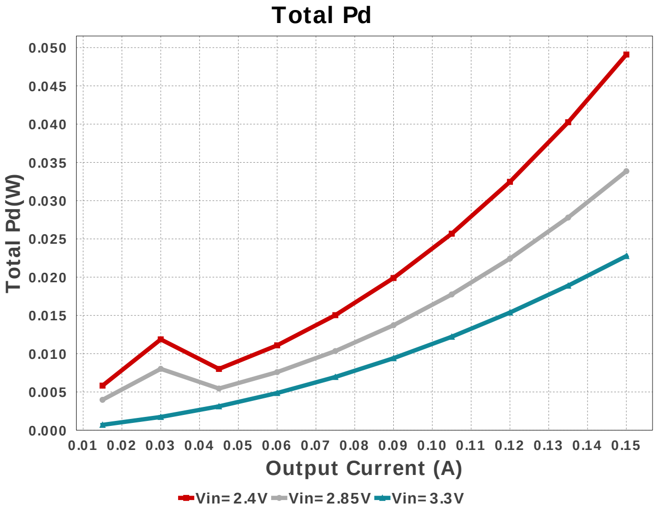


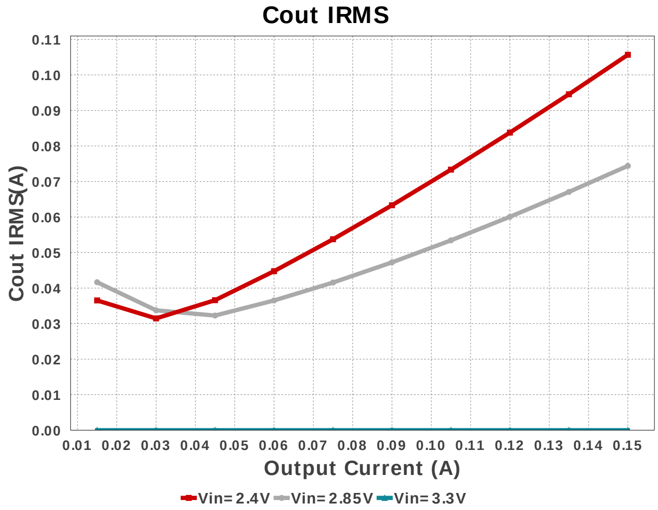

L1 Iavg
L1 Iavg(A)
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0.225
0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V

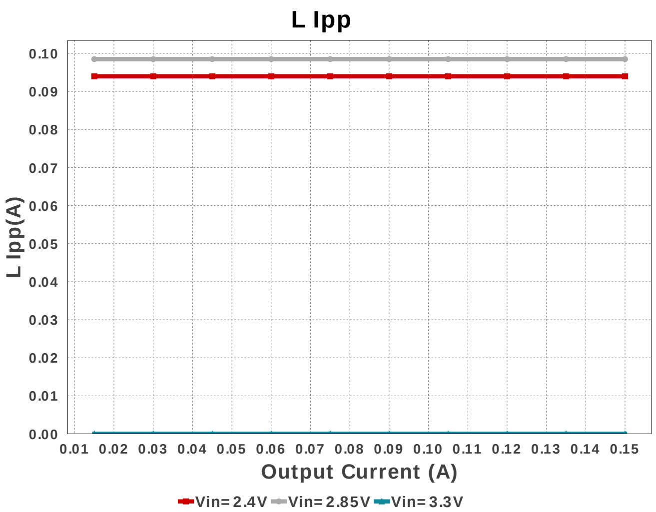

L1 Irms
L1 Irms(A)
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0.225
0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V

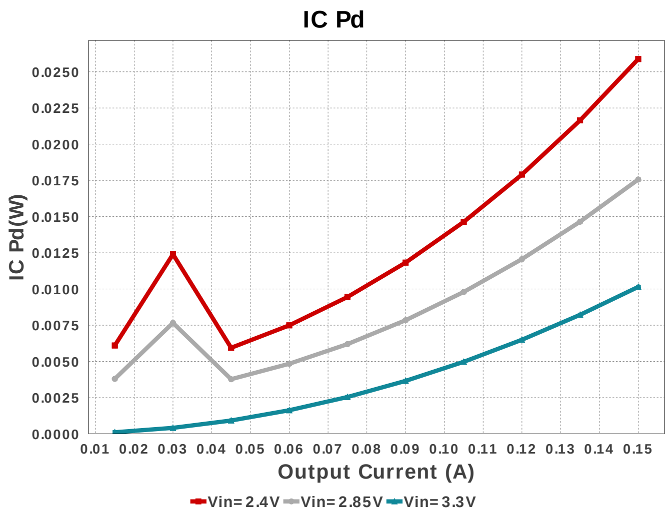

Pout
Pout(W)
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V


Iin Avg
Iin Avg(A)
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0.225
0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V


Total Pd
Total Pd(W)
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
0.045
0.050
0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V


Cout IRMS
Cout IRMS(A)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15
Output Current (A)
Vin=2.4V Vin=2.85V Vin=3.3V





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	27.135 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	736.33 nW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	105.67 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	5.583 µW	Capacitor	Output capacitor power dissipation
5.	IC Ipk	268.114 mA	IC	Peak switch current in IC
6.	IC Pd	25.879 mW	IC	IC power dissipation
7.	IC Tj	35.365 degC	IC	IC junction temperature
8.	ICThetaJA	207.3 degC/W	IC	IC junction-to-ambient thermal resistance
9.	Iin Avg	221.11 mA	IC	Average input current
10.	L Ipp	94.0 mA	Inductor	Peak-to-peak inductor ripple current
11.	L Pd	24.566 mW	Inductor	Inductor power dissipation
12.	L1 Iavg	221.114 mA	Inductor	Inductor average current
13.	L1 Irms	222.773 mA	Inductor	Inductor ripple current
14.	IOUT1_OP	150.0 mA	Op Point	Iout1 operating point
15.	IOUT2_OP	0.0 A	Op Point	Iout2 operating point
16.	Vout1 OP	3.3 V	Op Point	Operational Voltage 1
17.	Vout2 OP	3.0 V	Op Point	Operational Voltage 2
18.	Cin Pd	736.33 nW	Power	Input capacitor power dissipation
19.	Cout Pd	5.583 µW	Power	Output capacitor power dissipation
20.	IC Pd	25.879 mW	Power	IC power dissipation
21.	L Pd	24.566 mW	Power	Inductor power dissipation
22.	Total Pd	49.097 mW	Power	Total Power Dissipation
23.	BOM Count	8	System Information	Total Design BOM count
24.	Duty Cycle	32.162 %	System Information	Duty cycle
25.	Efficiency	90.748 %	System Information	Steady state efficiency
26.	FootPrint	35.0 mm^2	System Information	Total Foot Print Area of BOM components
27.	Frequency	949.534 kHz	System Information	Switching frequency
28.	Mode	BOOST PWM CCM	System Information	PWM/PFM Mode
29.	Pout	495.0 mW	System Information	Total output power
30.	Rload_crit	3.0 kOhm	System Information	Minimum Rload required during Start up
31.	Total BOM	$0.66	System Information	Total BOM Cost
32.	Vin	2.4 V	System Information	Vin operating point
33.	Vout Tolerance	303.03 m%	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
34.	Vout p-p	8.716 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	150.0 m	Maximum Output Current
VinMax	3.3	Maximum input voltage

Name	Value	Description
VinMin	2.4	Minimum input voltage
Vout	3.3	Output Voltage
base_pn	TPS610981	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

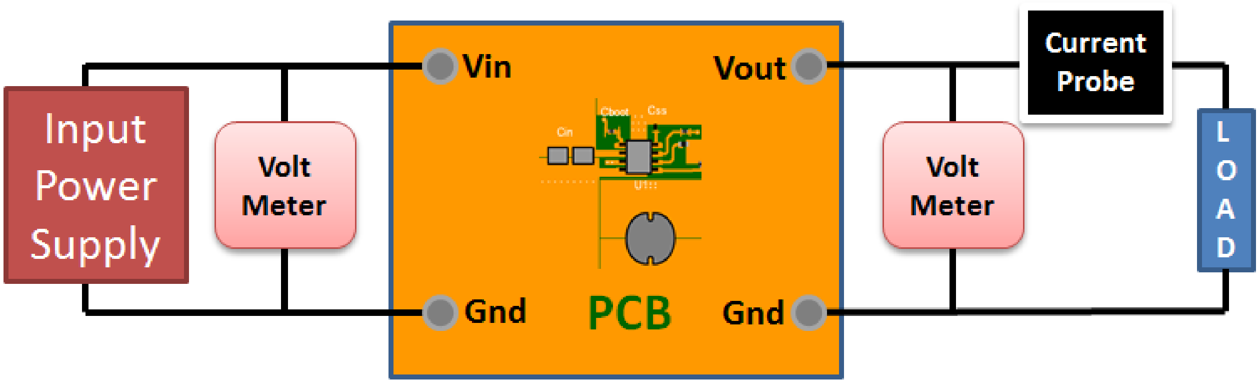
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 2.4V 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 : 0DD7EDB3DBABC043[v1]

2. **TPS610981** Product Folder : http://www.ti.com/product/tps610981 : contains the data sheet and other resources.

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