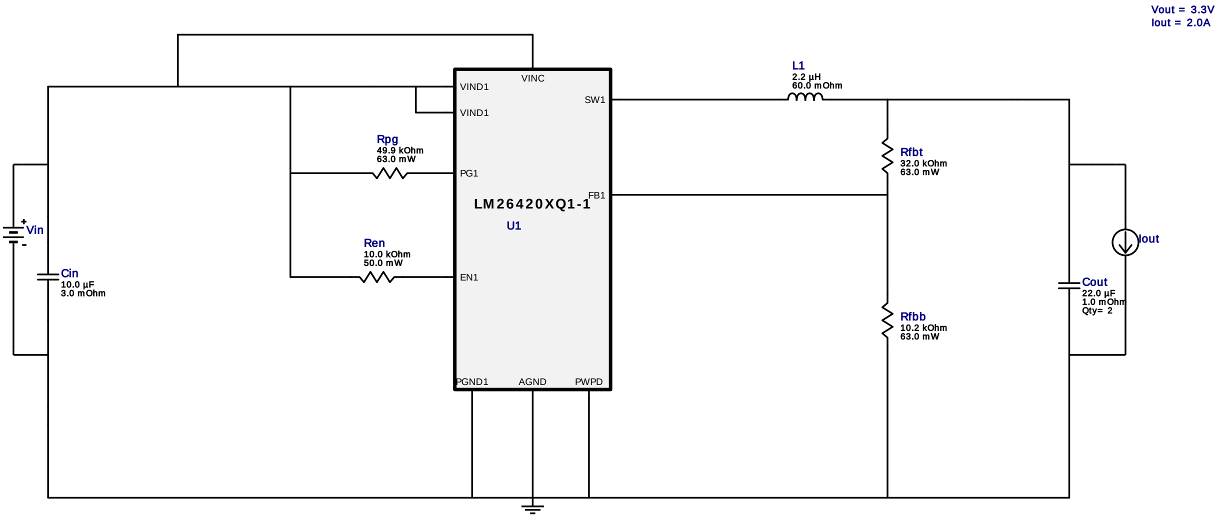
VinMin = 5.0V
VinMax = 5.0V
Vout = 3.3V
Iout = 2.0A

Device = LM26420Q1XSQ/NOPB
Topology = Buck
Created = 2023-10-05 03:15:02.807
BOM Cost = $1.66
BOM Count = 9
Total Pd = 0.98W

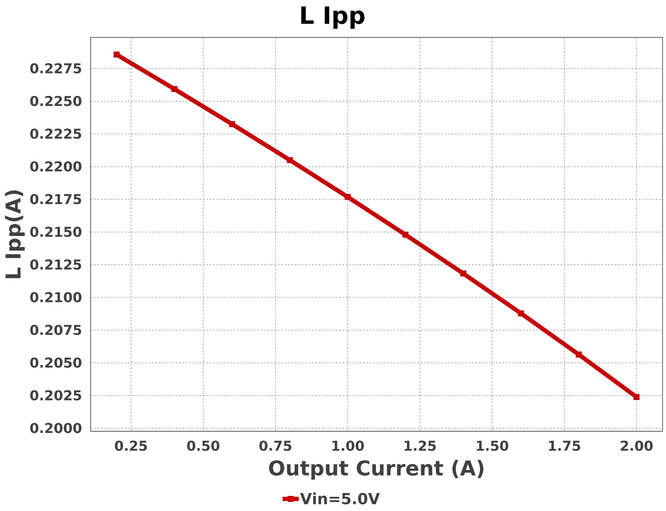
WEBENCH ® Design Report

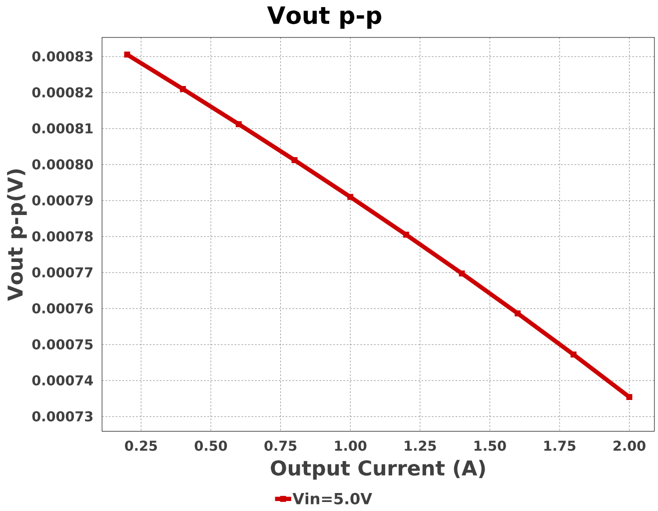
Design : 197 LM26420Q1XSQ/NOPB
LM26420Q1XSQ/NOPB 3V-5.5V to 1.20V @ 2A

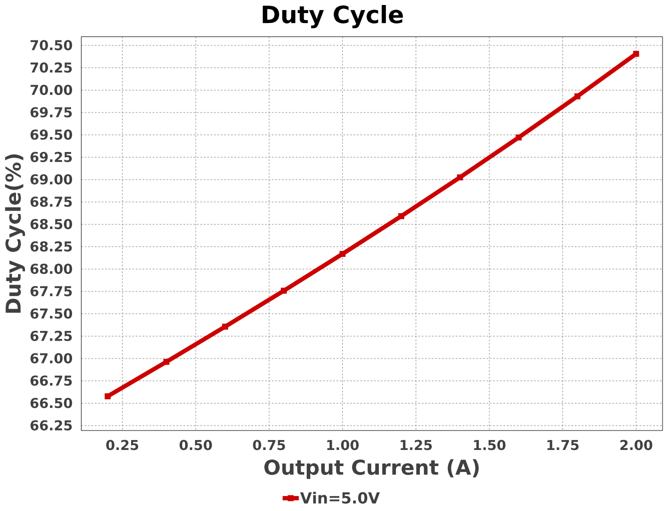


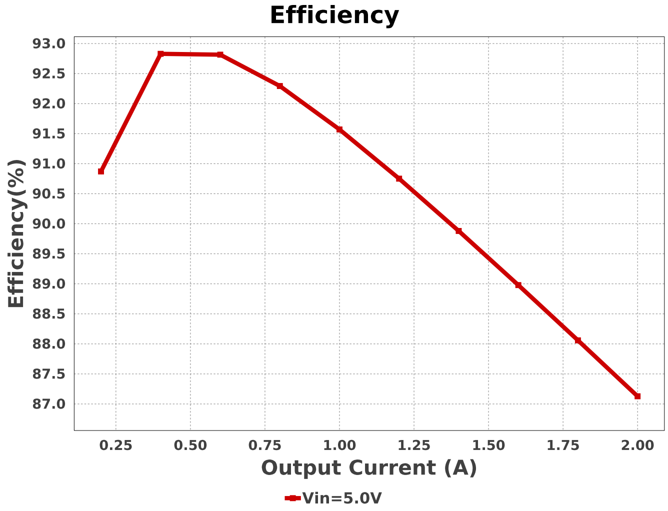
Electrical BOM

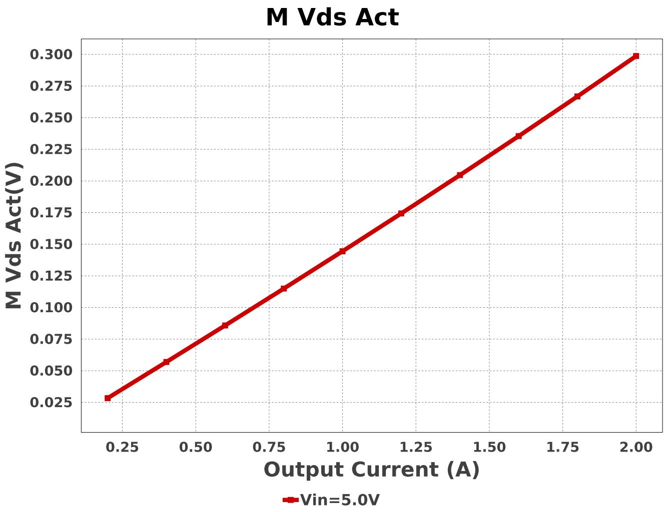
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	Kemet	C0805C106K8PACTU Series= X5R	Cap= 10.0 uF ESR= 3.0 mOhm VDC= 10.0 V IRMS= 11.43 A	1	$0.03	0805 7 mm²
Cout	MuRata	GRM188R60J226MEA0D Series= X5R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 6.0 A	2	$0.04	0603 5 mm²
L1	NIC Components	NPI43C2R2MTRF	L= 2.2 µH 60.0 mOhm	1	$0.07	IND_NPI43C 31 mm²
Ren	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm²
Rfbb	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rfbt	Vishay-Dale	TNPW040232K0BEED Series= ?	Res= 32.0 kOhm Power= 63.0 mW Tolerance= 0.1%	1	$0.11	0402 3 mm²
Rpg	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
U1	Texas Instruments	LM26420Q1XSQ/NOPB	Switcher	1	$1.34	RUM0016A 25 mm²

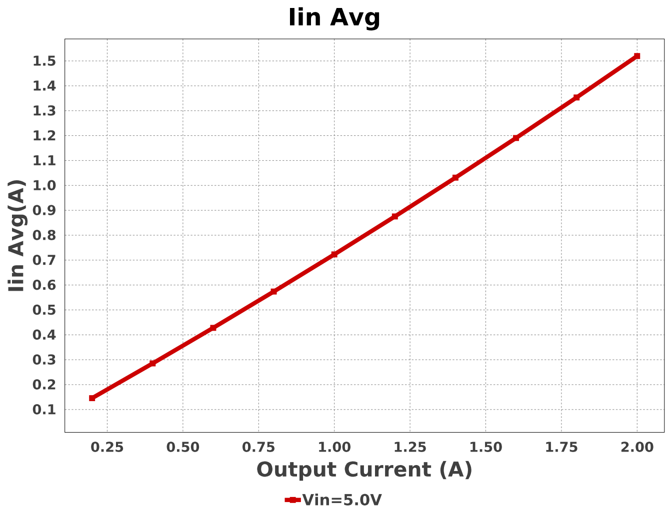

L Ipp
L Ipp(A)
0.2275
0.2250
0.2225
0.2200
0.2175
0.2150
0.2125
0.2100
0.2075
0.2050
0.2025
0.2000
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Output Current (A)
Vin=5.0V

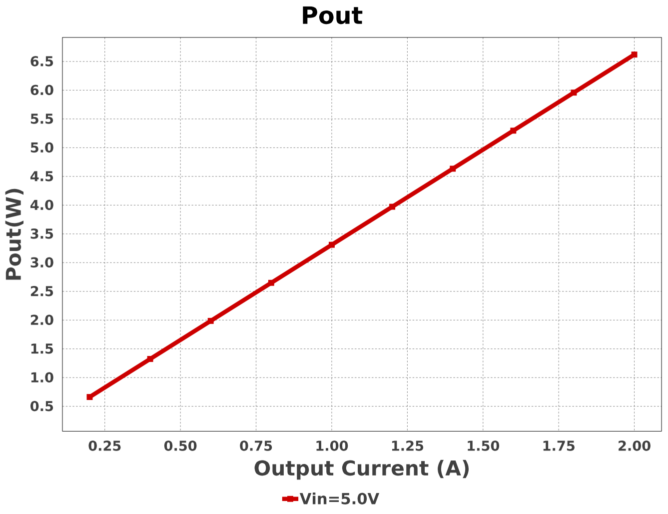

Vout p-p
Vout p-p(V)
0.00083
0.00082
0.00081
0.00080
0.00079
0.00078
0.00077
0.00076
0.00075
0.00074
0.00073
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Output Current (A)
Vin=5.0V

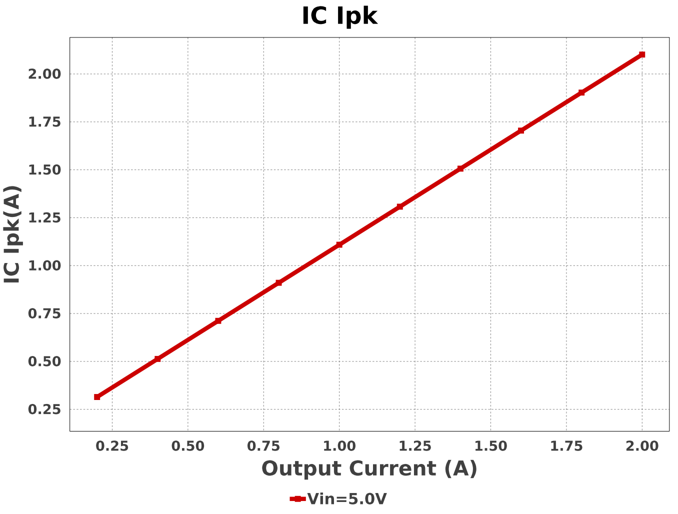

Duty Cycle
Duty Cycle(%)
70.50
70.25
70.00
69.75
69.50
69.25
69.00
68.75
68.50
68.25
68.00
67.75
67.50
67.25
67.00
66.75
66.50
66.25
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Output Current (A)
Vin=5.0V

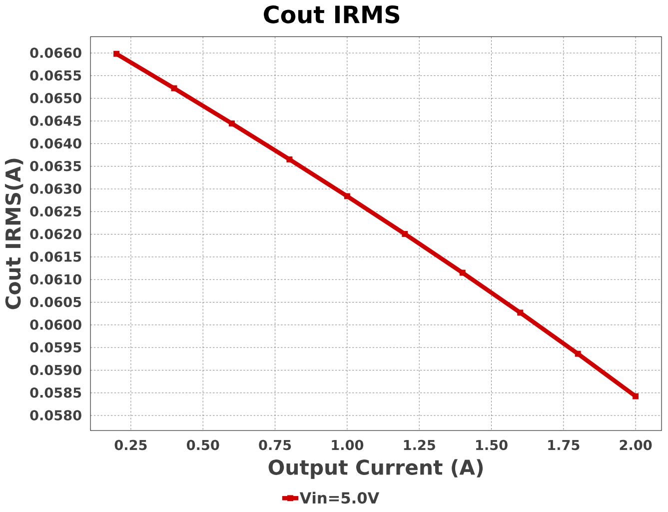

Efficiency
Efficiency(%)
93.0
92.5
92.0
91.5
91.0
90.5
90.0
89.5
89.0
88.5
88.0
87.5
87.0
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Output Current (A)
Vin=5.0V

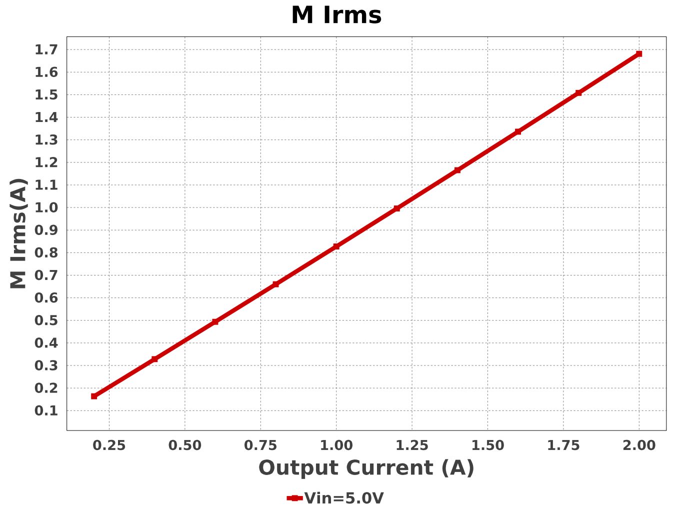

M Vds Act
M Vds Act(V)
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Output Current (A)
Vin=5.0V

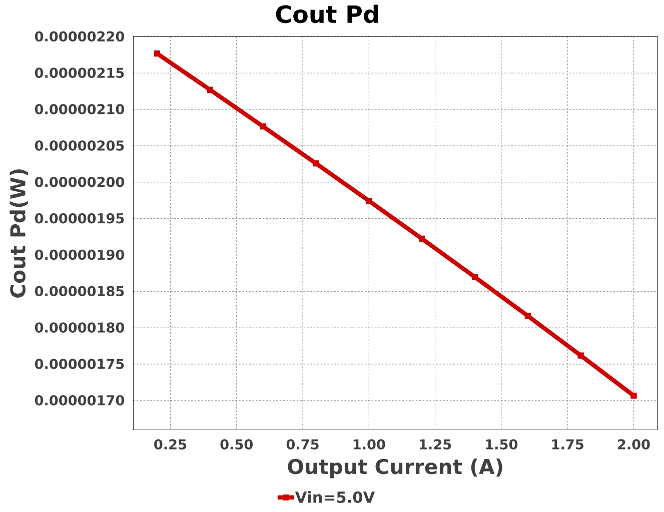

Iin Avg
Iin Avg(A)
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Output Current (A)
Vin=5.0V

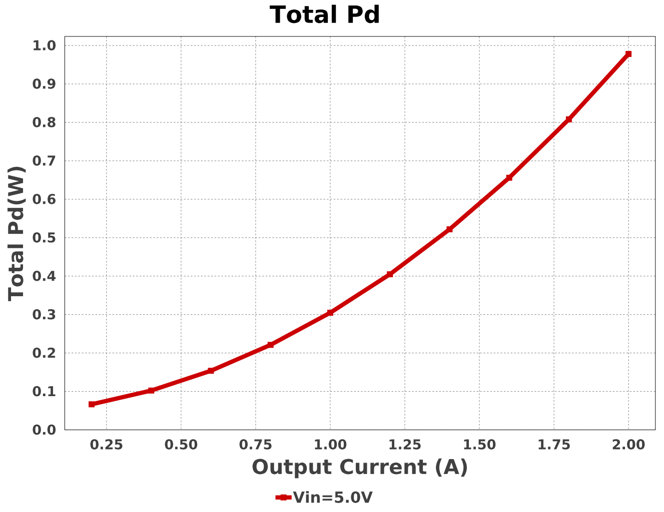

Pout
Pout(W)
Output Current (A)
Vin=5.0V

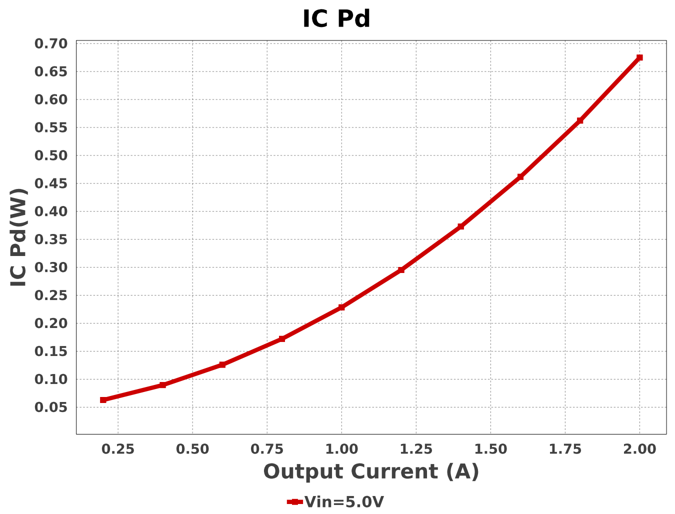

IC Ipk
IC Ipk(A)
Output Current (A)
Vin=5.0V

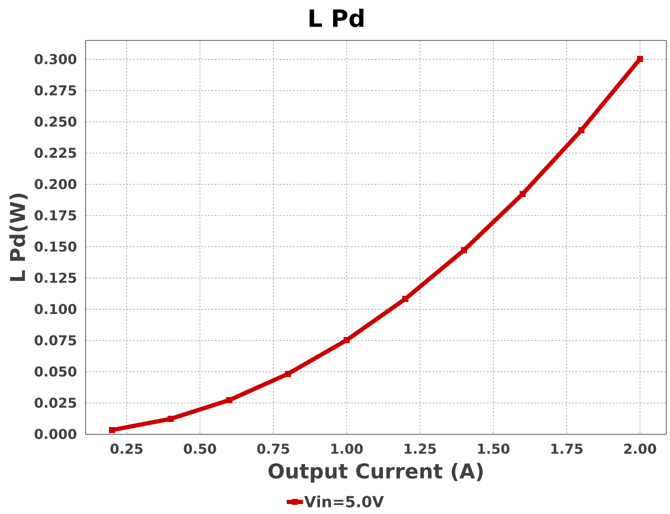

Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=5.0V

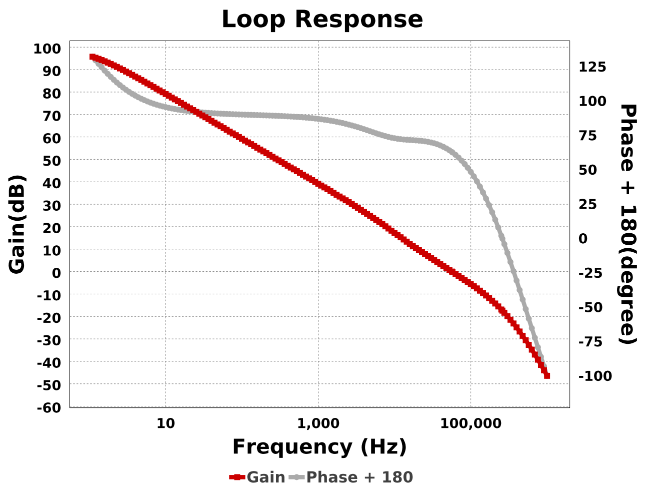

M Irms
M Irms(A)
Output Current (A)
Vin=5.0V


Cout Pd
Cout Pd(W)
Output Current (A)
Vin=5.0V


Total Pd
Total Pd(W)
Output Current (A)
Vin=5.0V







Operating Values

#	Name	Value	Category	Description
1.	Cout IRMS	58.425 mA	Capacitor	Output capacitor RMS ripple current
2.	Cout Pd	1.707 µW	Capacitor	Output capacitor power dissipation
3.	IC Ipk	2.101 A	IC	Peak switch current in IC
4.	IC Pd	674.97 mW	IC	IC power dissipation
5.	IC Tolerance	20.0 mV	IC	IC Feedback Tolerance
6.	Iin Avg	1.52 A	IC	Average input current
7.	L Ipp	202.389 mA	Inductor	Peak-to-peak inductor ripple current
8.	L Pd	300.28 mW	Inductor	Inductor power dissipation
9.	M1 Irms	1.681 A	Mosfet	Q Iavg
10.	M Vds Act	298.691 mV	Mosfet	Voltage drop across the MosFET
11.	Cout Pd	1.707 µW	Power	Output capacitor power dissipation
12.	IC Pd	674.97 mW	Power	IC power dissipation
13.	L Pd	300.28 mW	Power	Inductor power dissipation
14.	Total Pd	978.015 mW	Power	Total Power Dissipation
15.	BOM Count	9	System Information	Total Design BOM count
16.	Cross Freq	56.695 kHz	System Information	Bode plot crossover frequency
17.	Duty Cycle	70.406 %	System Information	Duty cycle
18.	Efficiency	87.128 %	System Information	Steady state efficiency
19.	FootPrint	83.0 mm^2	System Information	Total Foot Print Area of BOM components
20.	Frequency	2.2 MHz	System Information	Switching frequency
21.	Gain Marg	-17.414 dB	System Information	Bode Plot Gain Margin
22.	Iout	2.0 A	System Information	Iout operating point
23.	Low Freq Gain	95.741 dB	System Information	Gain at 1Hz

#	Name	Value	Category	Description
24.	Mode	CCM	System Information	Conduction Mode
25.	Phase Marg	62.985 deg	System Information	Bode Plot Phase Margin
26.	Pout	6.62 W	System Information	Total output power
27.	Total BOM	$1.656	System Information	Total BOM Cost
28.	Vin	5.0 V	System Information	Vin operating point
29.	Vout	3.31 V	System Information	Operational Output Voltage
30.	Vout Actual	3.31 V	System Information	Vout Actual calculated based on selected voltage divider resistors
31.	Vout Tolerance	3.364 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
32.	Vout p-p	735.437 µV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	2.0	Maximum Output Current
VinMax	5.0	Maximum input voltage
VinMin	5.0	Minimum input voltage
Vout	3.3	Output Voltage
base_pn	LM26420X-Q1/1	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

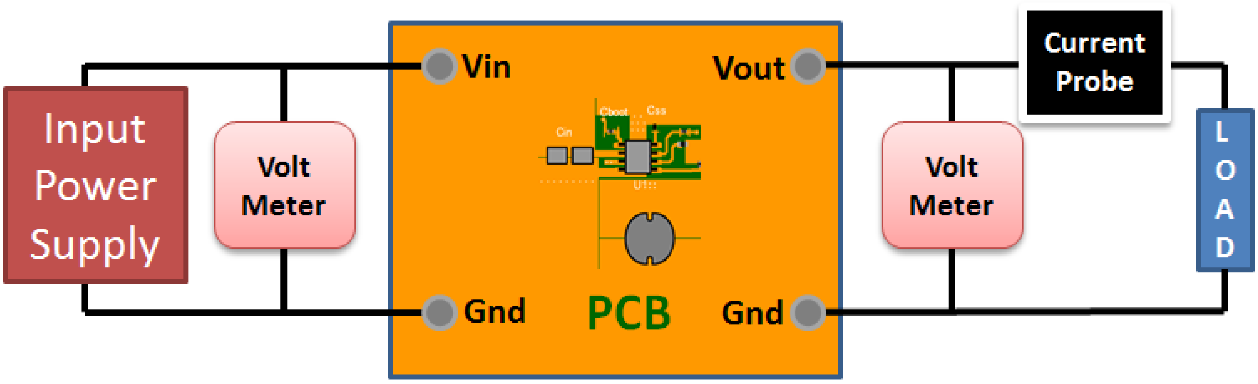
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 5.0V 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.

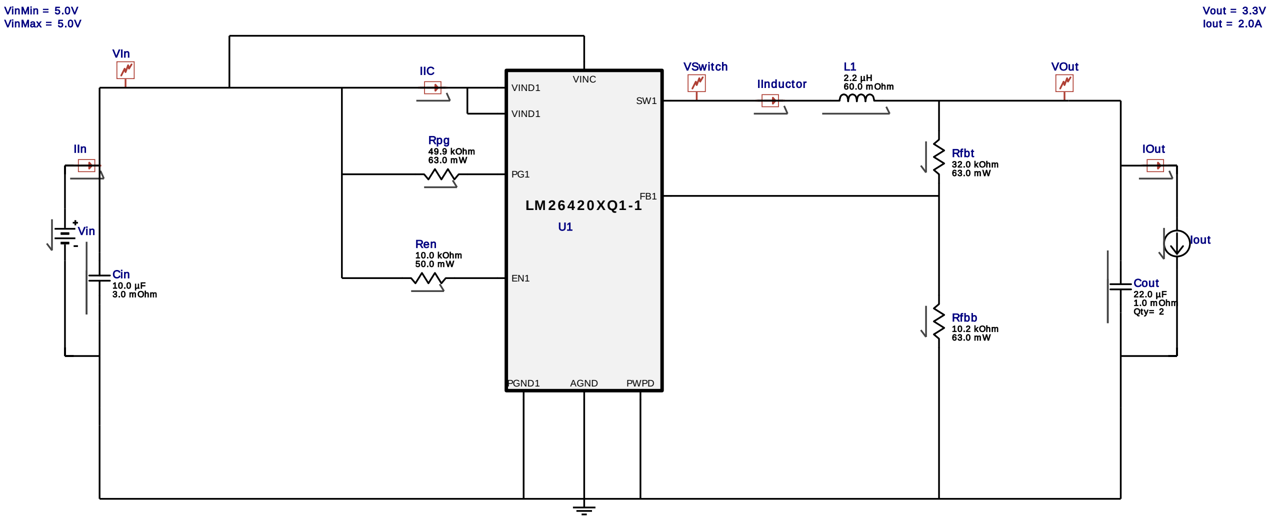


WEBENCH® Electrical Simulation Report

Design Id = 197

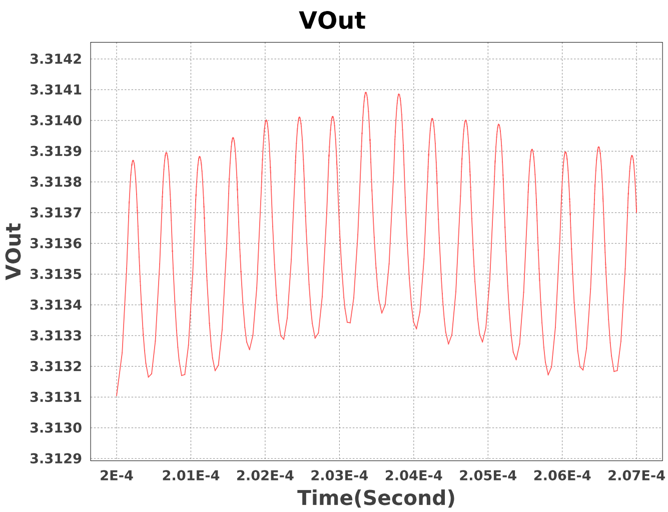
sim_id = 1

Simulation Type = Steady State



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cout	IC	no description	3.31 V
2.	L1	IC	Initial Current	IC_Inductor A
3.	Iout	I	Load Current	2.0 A



Design Assistance

1. Master key : 4787750D4FBA71E4[v1]

2. **LM26420X-Q1/1** Product Folder : http://www.ti.com/product/LM26420%2DQ1 : contains the data sheet and other resources.

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