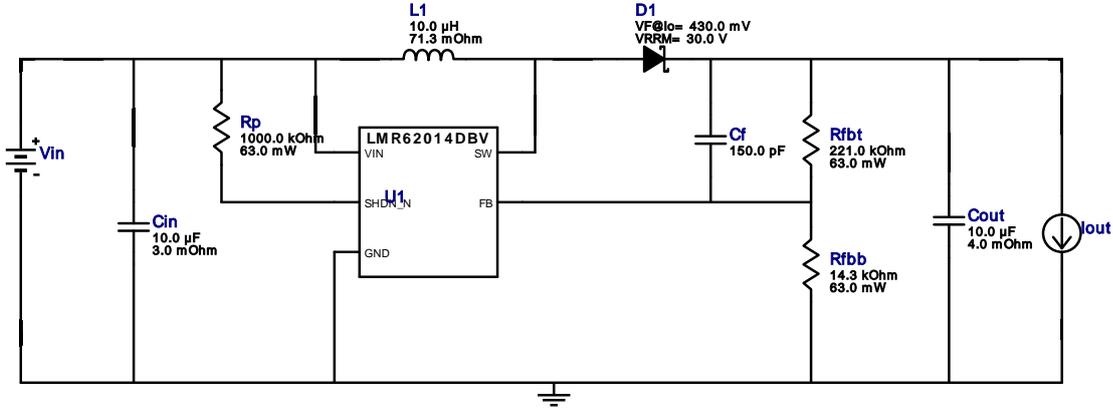


VinMin = 4.75V
 VinMax = 5.25V
 Vout = 20.0V
 Iout = 0.25A

Device = LMR62014XMF/NOPB
 Topology = Boost
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 BOM Cost = \$1.90
 BOM Count = 9
 Total Pd = 0.97W

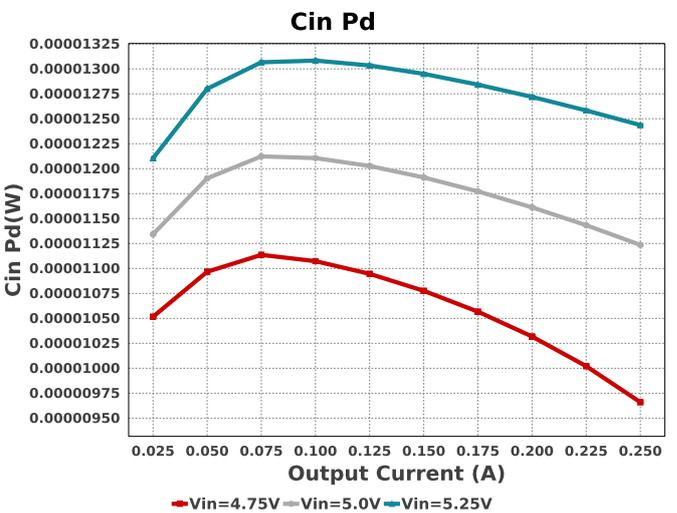
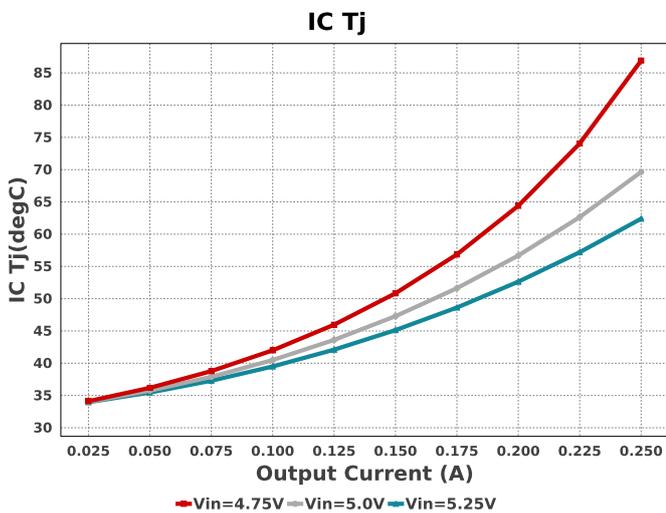
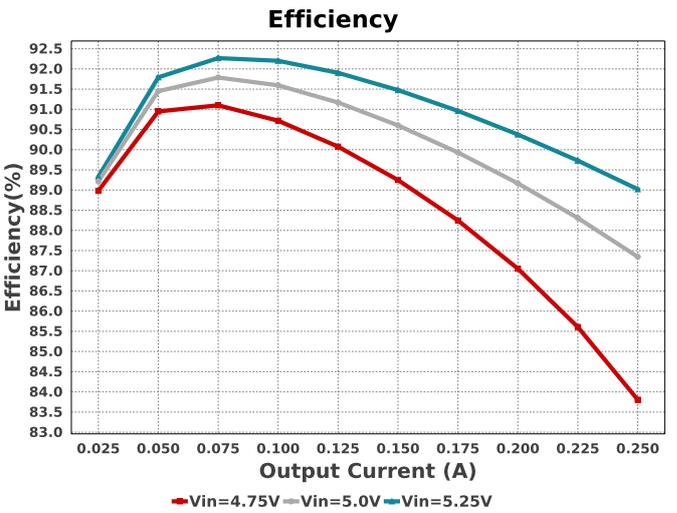
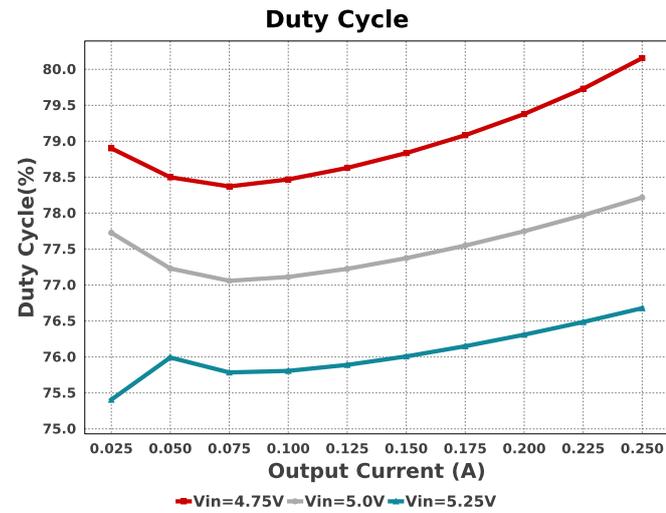
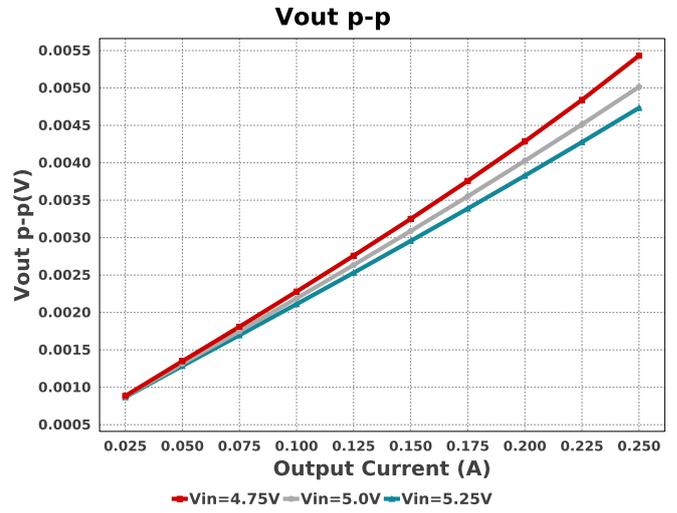
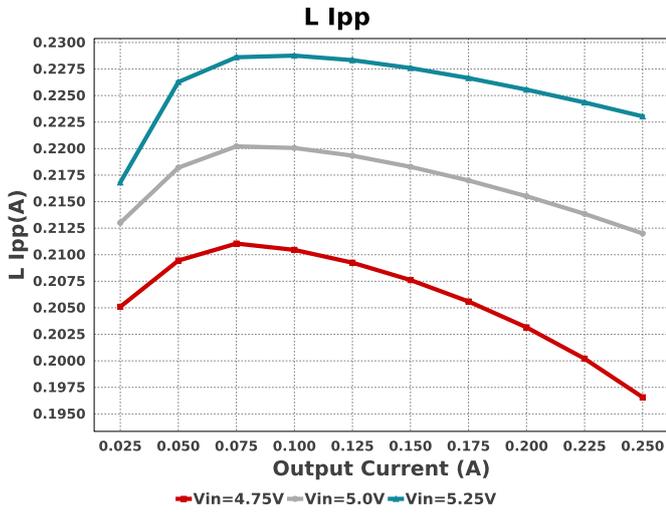
WEBENCH[®] Design Report

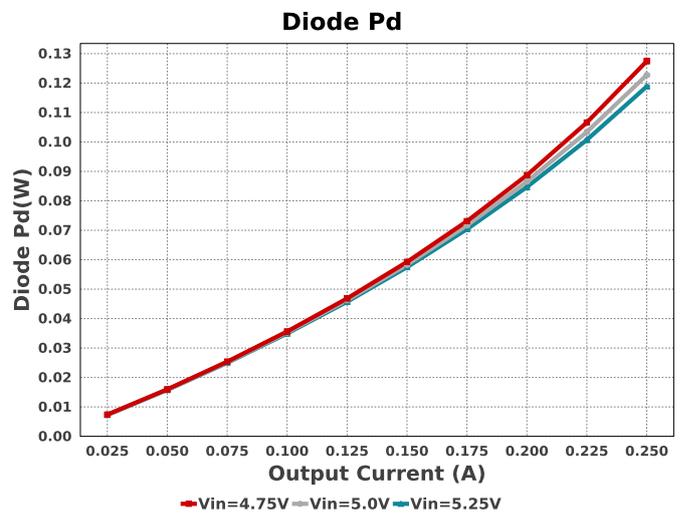
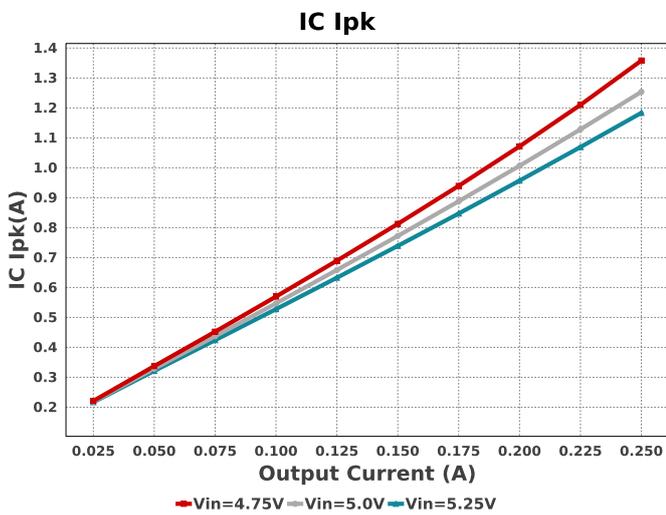
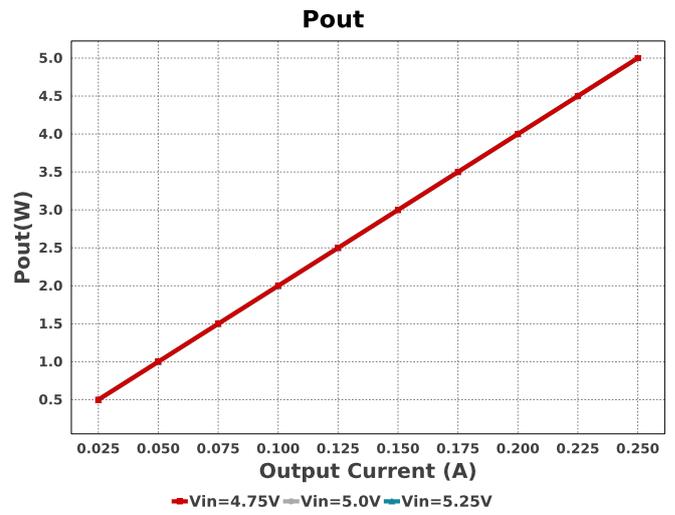
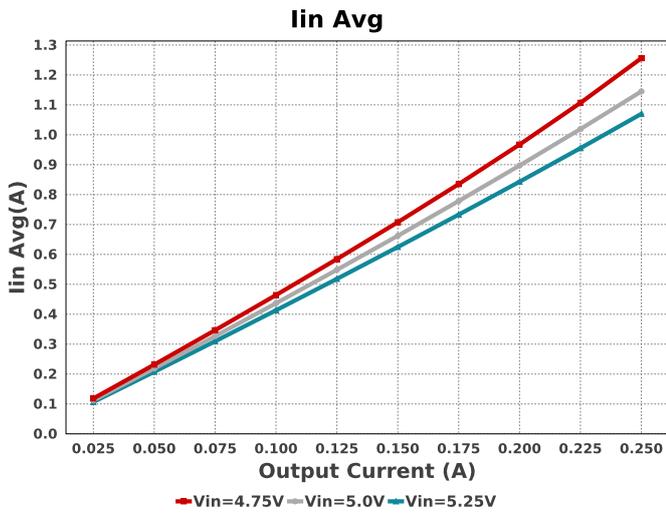
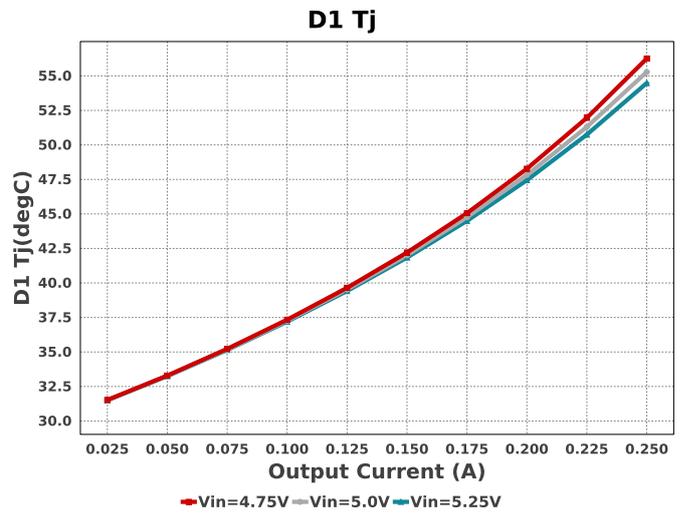
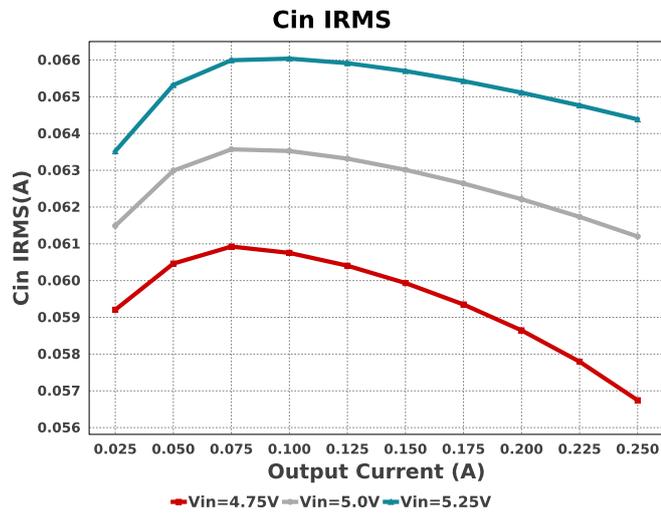
Design : 3 LMR62014XMF/NOPB
 LMR62014XMF/NOPB 4.75V-5.25V to 20.00V @ 0.25A

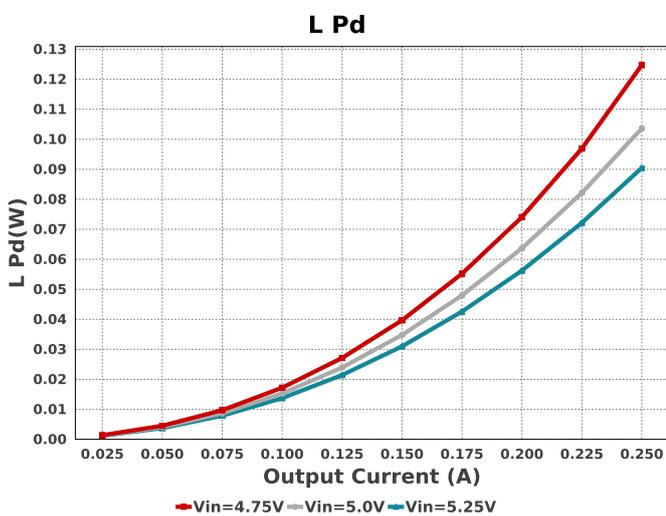
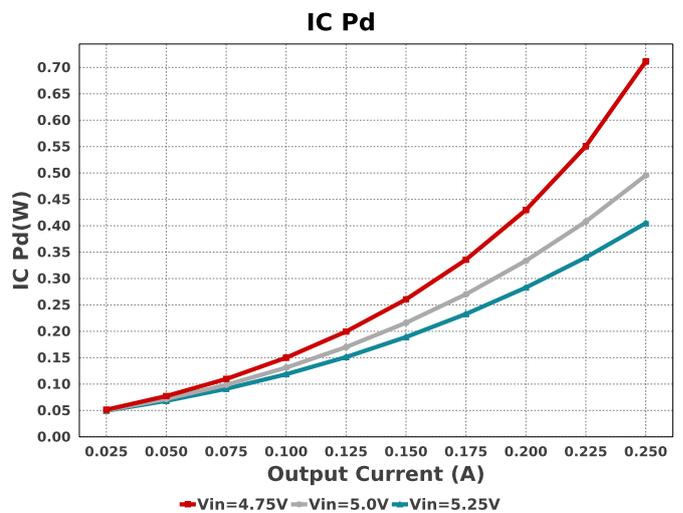
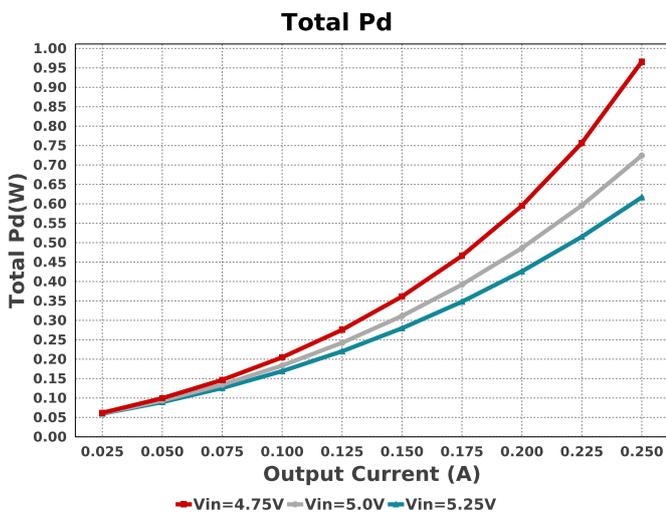
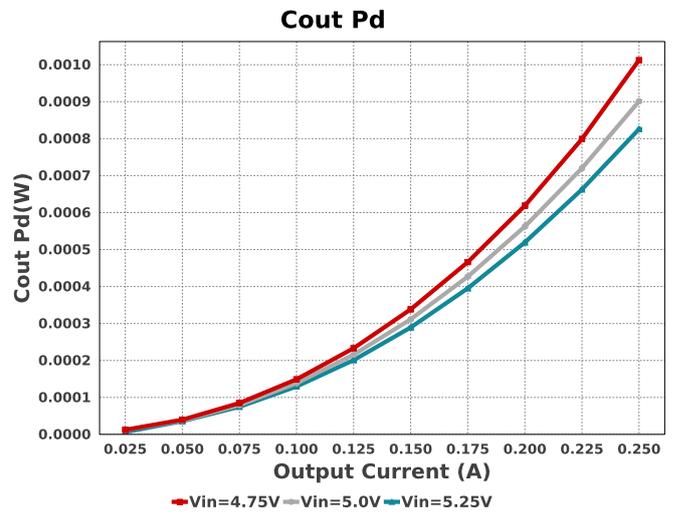
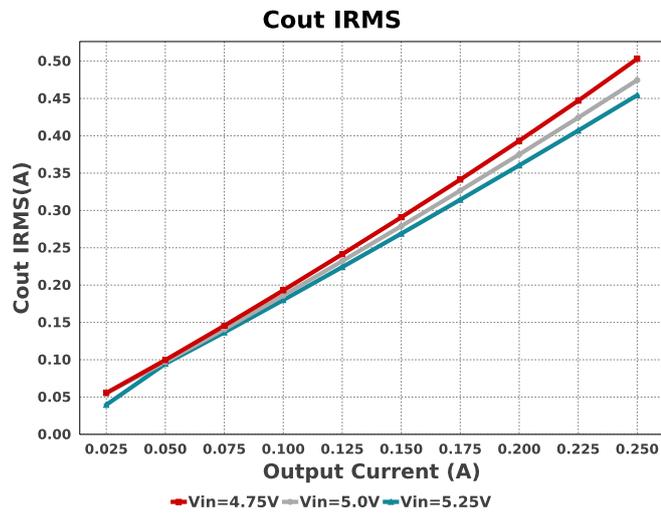


Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cf	Samsung Electro-Mechanics	CL21C151JBANNNC Series= C0G/NP0	Cap= 150.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
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 mm ²
Cout	MuRata	GRM21BR61E106MA73L Series= X5R	Cap= 10.0 uF ESR= 4.0 mOhm VDC= 25.0 V IRMS= 2.8 A	1	\$0.05	0805 7 mm ²
D1	ON Semiconductor	MBR0530T1G	VF@Io= 430.0 mV VRRM= 30.0 V	1	\$0.05	SOD-123 13 mm ²
L1	Vishay-Dale	IHLP2525EZER100M01	L= 10.0 uH 71.3 mOhm	1	\$1.40	IHLP-2525EZ 75 mm ²
Rfbb	Vishay-Dale	CRCW040214K3FKED Series= CRCW..e3	Res= 14.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rfbb	Vishay-Dale	CRCW0402221KFKED Series= CRCW..e3	Res= 221.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rp	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
U1	Texas Instruments	LMR62014XMF/NOPB	Switcher	1	\$0.33	DBV0005A 15 mm ²







Operating Values

#	Name	Value	Category	Description
1.	BOM Count	9		Total Design BOM count
2.	Total BOM	\$1.9		Total BOM Cost
3.	Cin IRMS	56.745 mA	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	9.66 μ W	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	503.092 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	1.012 mW	Capacitor	Output capacitor power dissipation
7.	D1 Tj	56.253 degC	Diode	D1 junction temperature
8.	Diode Pd	127.44 mW	Diode	Diode power dissipation
9.	IC Ipk	1.358 A	IC	Peak switch current in IC
10.	IC Pd	711.27 mW	IC	IC power dissipation
11.	IC Tj	86.902 degC	IC	IC junction temperature

#	Name	Value	Category	Description
12.	Iin Avg	1.256 A	IC	Average input current
13.	L Ipp	196.571 mA	Inductor	Peak-to-peak inductor ripple current
14.	L Pd	124.74 mW	Inductor	Inductor power dissipation
15.	Cin Pd	9.66 μ W	Power	Input capacitor power dissipation
16.	Cout Pd	1.012 mW	Power	Output capacitor power dissipation
17.	Diode Pd	127.44 mW	Power	Diode power dissipation
18.	IC Pd	711.27 mW	Power	IC power dissipation
19.	L Pd	124.74 mW	Power	Inductor power dissipation
20.	Total Pd	966.134 mW	Power	Total Power Dissipation
21.	Duty Cycle	80.156 %	System	Duty cycle
22.	Efficiency	83.806 %	System Information	Steady state efficiency
23.	FootPrint	132.0 mm ²	System Information	Total Foot Print Area of BOM components
24.	Frequency	1.6 MHz	System Information	Switching frequency
25.	Iout	250.0 mA	System Information	Iout operating point
26.	Mode	CCM	System Information	Conduction Mode
27.	Pout	5.0 W	System Information	Total output power
28.	Vin	4.75 V	System Information	Vin operating point
29.	Vout Actual	20.239 V	System Information	Vout Actual calculated based on selected voltage divider resistors
30.	Vout Tolerance	3.969 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
31.	Vout p-p	5.433 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	250.0 m	Maximum Output Current
VinMax	5.25	Maximum input voltage
VinMin	4.75	Minimum input voltage
Vout	20.0	Output Voltage
base_pn	LMR62014X	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 C_{in} and C_{out} , 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

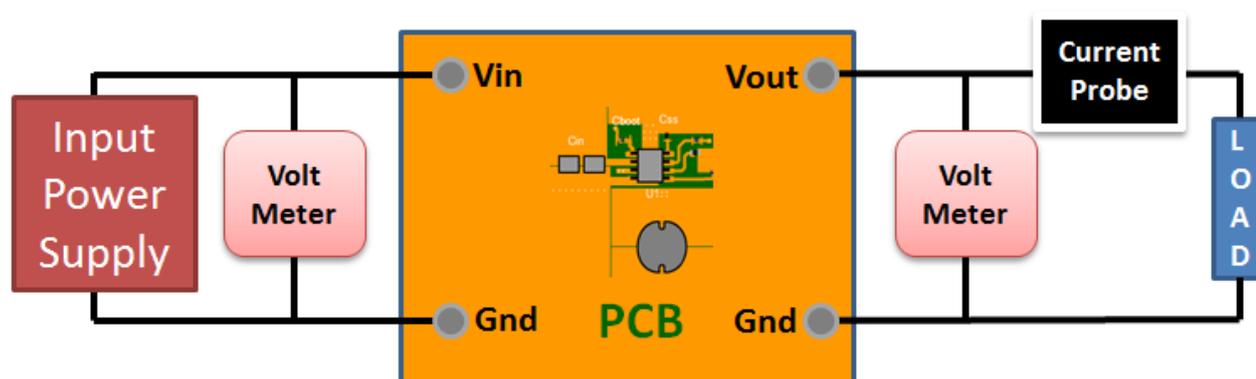
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab down 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 4.75V and set the input supply's current limit to zero. With the input supply off connect up the input supply to V_{in} and GND. Connect a digital volt meter and a load if needed to set the minimum load of the design from V_{out} 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 V_{in} and GND, a load is connected between V_{out} and GND and a current meter is connected in series between V_{out} 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.

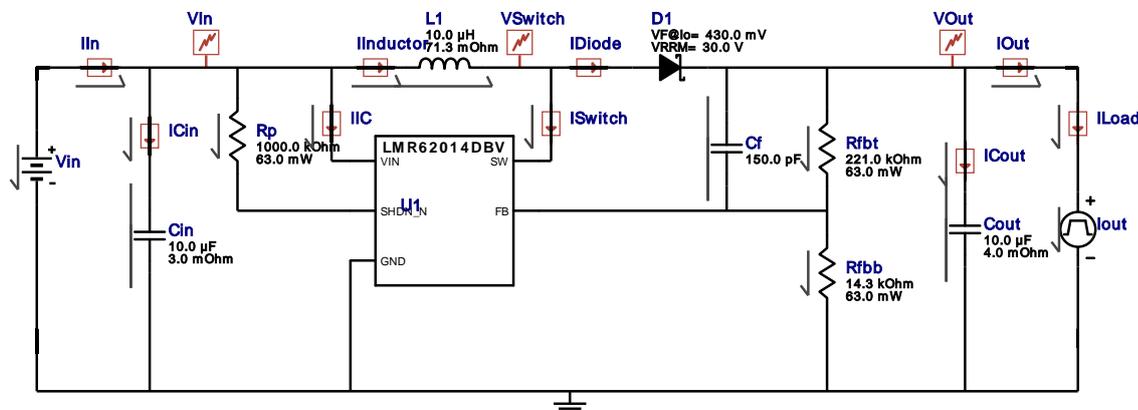


WEBENCH® Electrical Simulation Report

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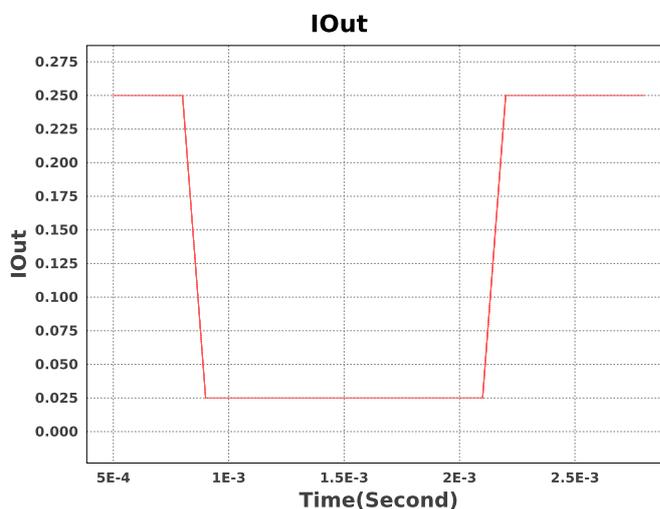
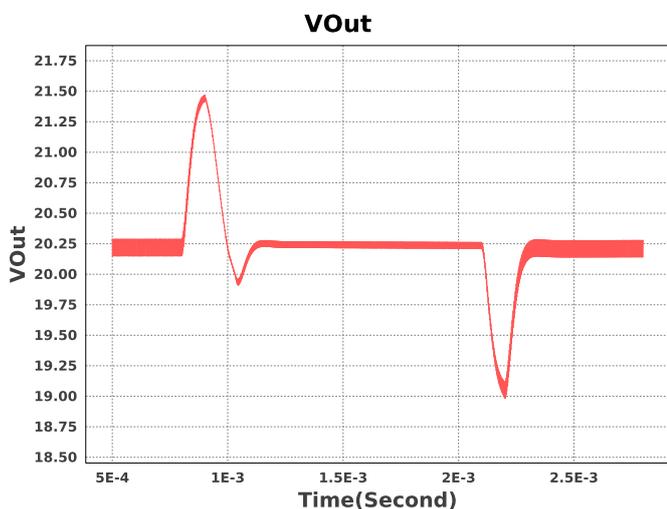
sim_id = 18

Simulation Type = Load Transient



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Iout	signal_type	Signal Type	PULSE
		I1	Initial Load Current	0.25 A
		I2	Minimum Load Current	0.025 A
		Td	Initial Time Delay	800u s
		Tr	Rise Time	100u s
		Tf	Fall Time	100u s
		Pw	Pulse Width	1.2m s



Design Assistance

1. Master key : F791A8341385FC157FB4A6231A3C9A32[v1]

2. **LMR62014X** Product Folder : <http://www.ti.com/product/LMR62014> : contains the data sheet and other resources.

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