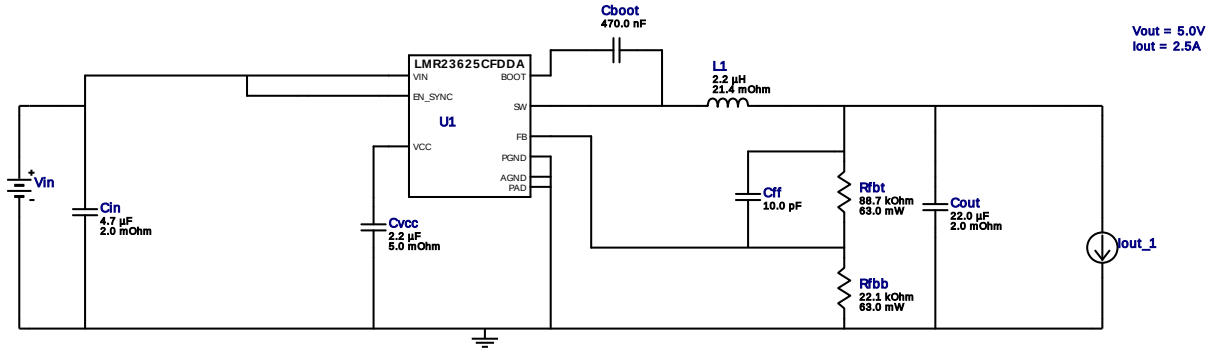
WEBENCH® Design Report

VinMin = 14.0V
VinMax = 20.0V
Vout = 5.0V
Iout = 2.5A

Device = LMR23625CFDDAR
Topology = Buck
Created = 7/4/16 9:27:46 PM
BOM Cost = $2.46
BOM Count = 9
Total Pd = 2.89W

Design : 3454786/84 LMR23625CFDDAR
LMR23625CFDDAR 14.0V-20.0V to 5.00V @ 2.5A



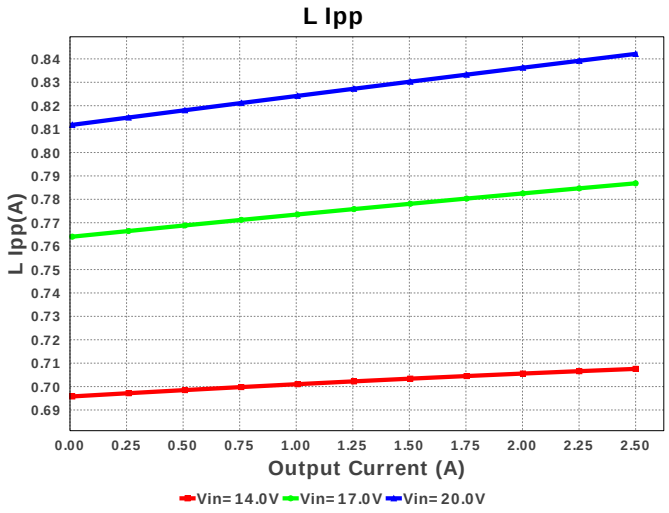
1. The input capacitor included in the BOM only contains a small filter capacitor that should be placed near the IC. Depending on where the power supply is laid out in the system additional bulk capacitance may need to be added to filter the line ripple.

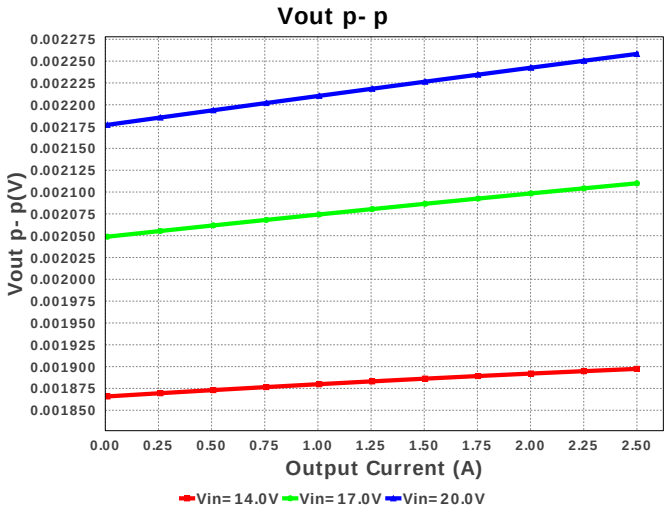
2. If there is no VinTyp specified, WEBENCH will use the VinMax value. To change the VinTyp value, click on the "Change Design Inputs" button under the Optimization Tuning knob. In some applications, while the design requires the input voltage to be a wide range, for a majority of the time, it is operating at a much lower voltage than the maximum input voltage. Sizing the inductor based on the maximum input voltage may yield an inductance much larger than typically needed, causing a larger footprint for the overall design. At the same time, components such as the input capacitor must be rated based on the maximum input voltage. WEBENCH now supports the use of this additional input voltage specification.

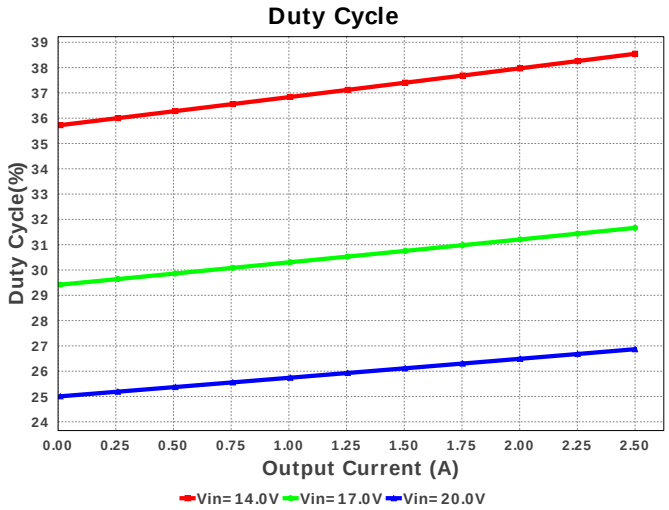
Electrical BOM

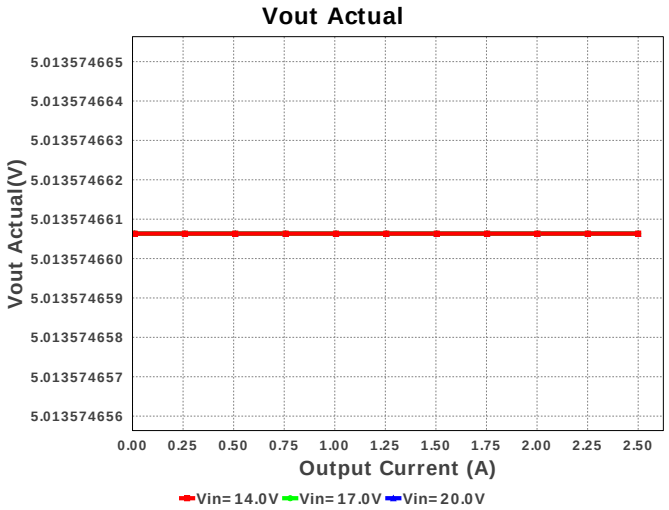
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM21BR71H474KA88L Series= X7R	Cap= 470.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.05	0805 7 mm²
2.	Cff	Kemet	C0805C100M4GACTU Series= C0G/NP0	Cap= 10.0 pF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Cin	MuRata	GRM32ER71H475KA88L Series= X7R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 50.0 V IRMS= 5.35 A	1	$0.19	1210 15 mm²
4.	Cout	MuRata	GRM32ER61C226ME20L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 16.0 V IRMS= 3.68 A	1	$0.12	1210 15 mm²
5.	Cvcc	MuRata	GRM155R60J225ME15D Series= X5R	Cap= 2.2 uF ESR= 5.0 mOhm VDC= 6.3 V IRMS= 3.67 A	1	$0.02	0402 3 mm²
6.	L1	Coilcraft	XFL4020-222MEB	L= 2.2 µH DCR= 21.4 mOhm	1	$0.55	XFL4020 25 mm²
7.	Rfbb	Vishay-Dale	CRCW040222K1FKED Series= CRCW..e3	Res= 22.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
8.	Rfbt	Vishay-Dale	CRCW040288K7FKED Series= CRCW..e3	Res= 88.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	U1	Texas Instruments	LMR23625CFDDAR	Switcher	1	$1.50	DDA0008E_N 57 mm²

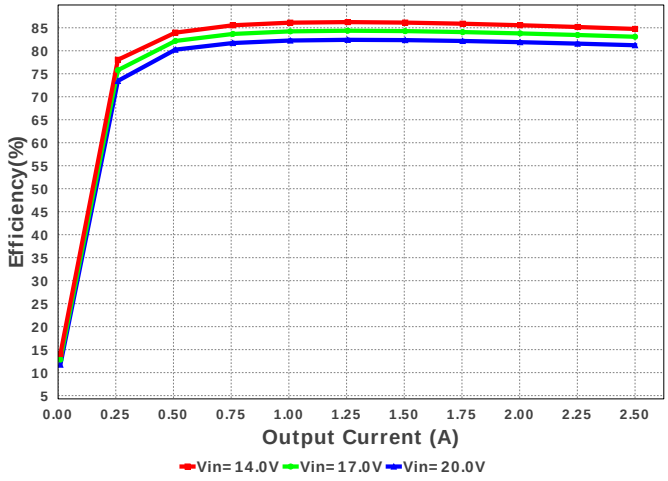




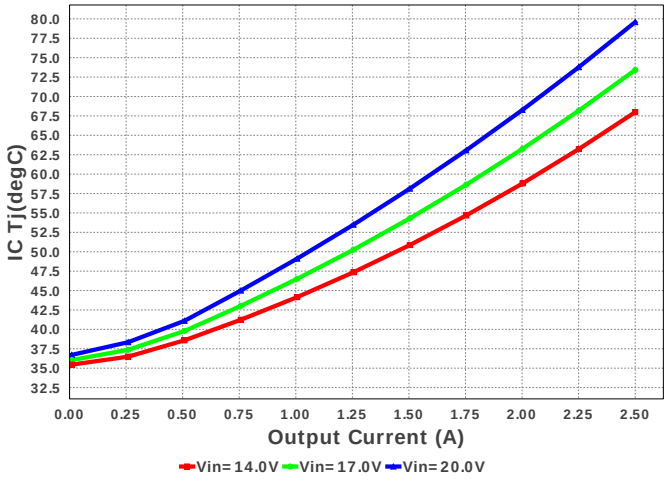




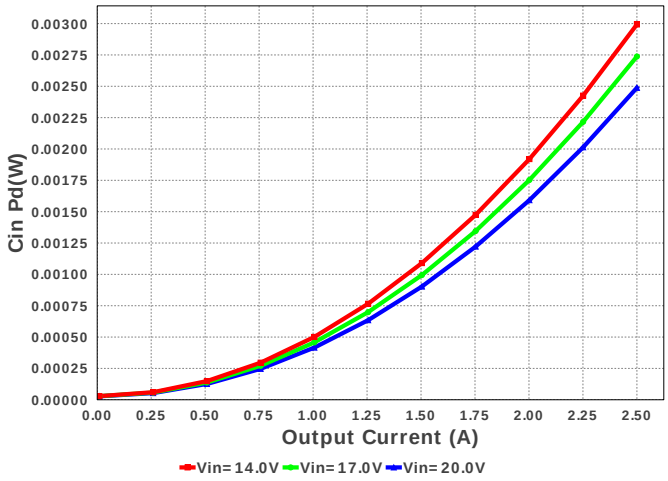
Efficiency



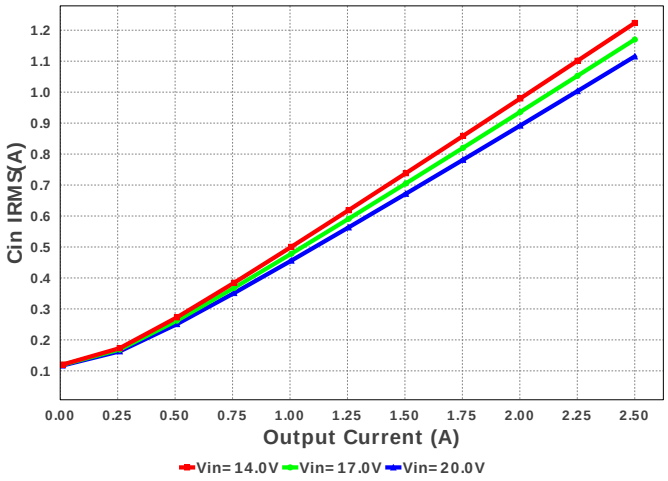
IC Tj



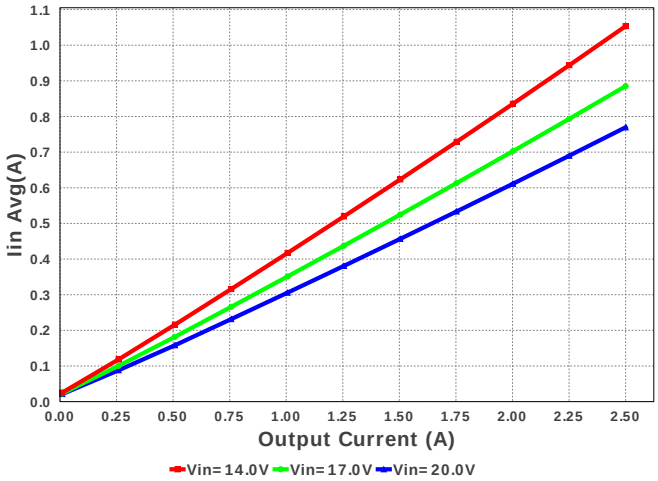
Cin Pd



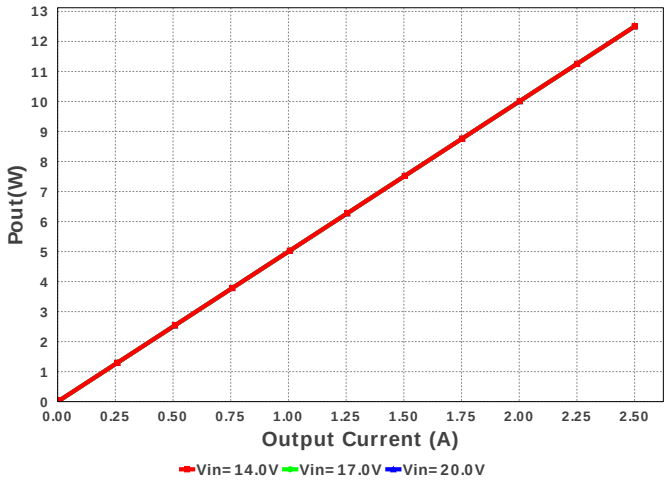
Cin IRMS

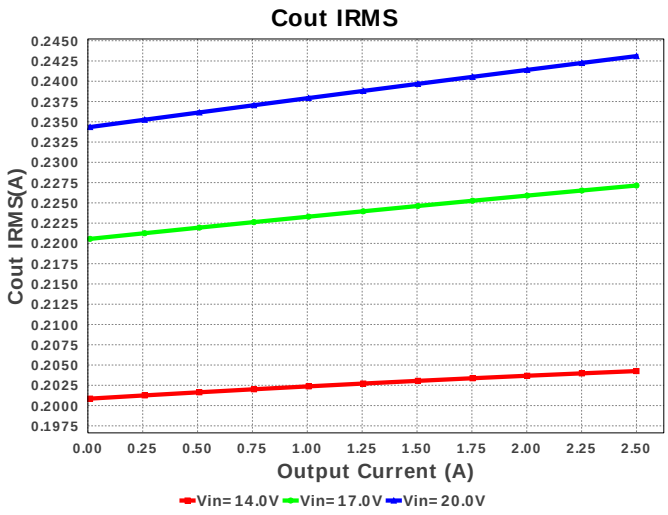


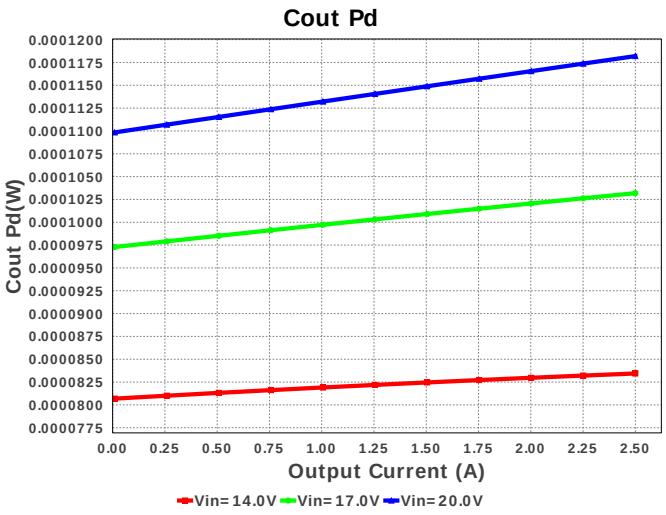
Iin Avg

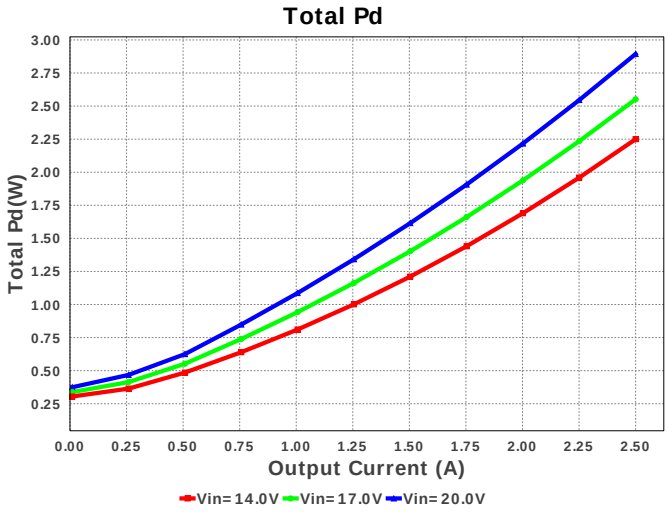


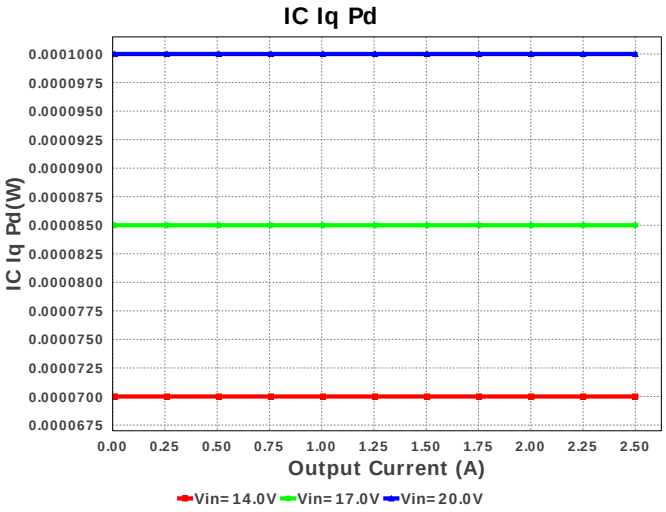
Pout

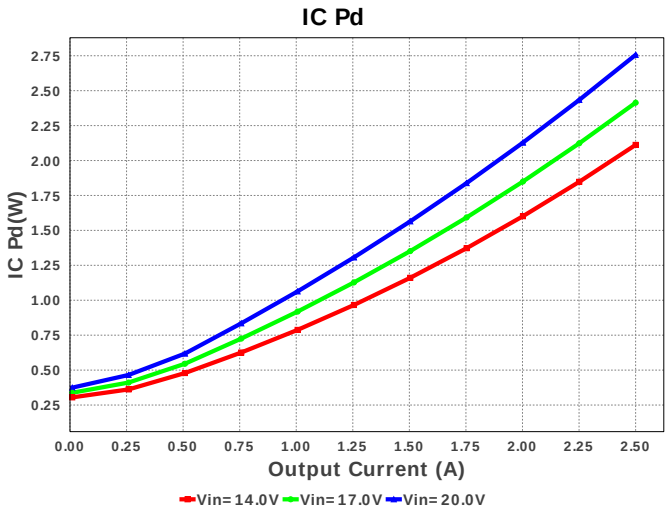


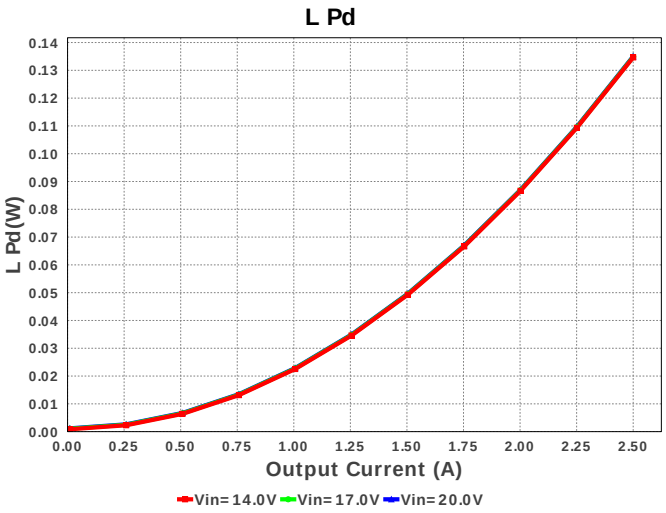


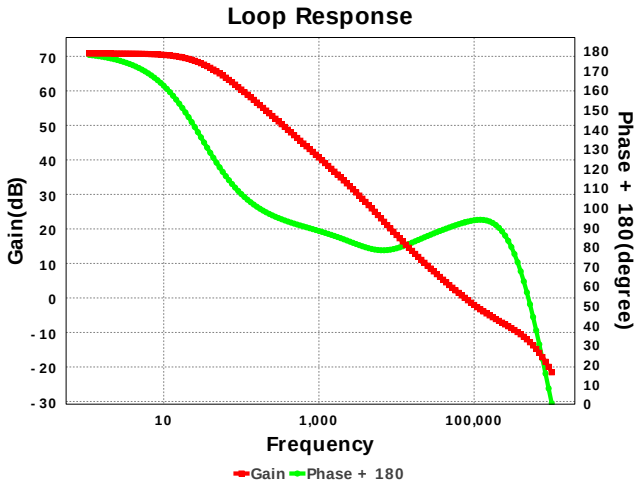


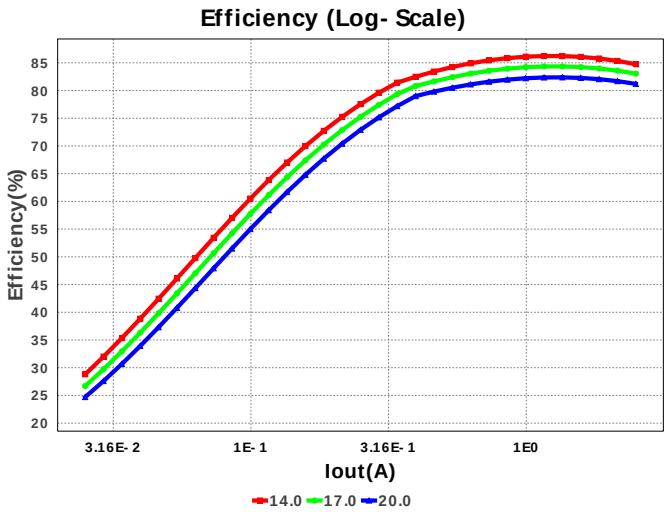












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.115 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	243.101 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	769.63 mA	Current	Average input current
4.	L Ipp	842.13 mA	Current	Peak-to-peak inductor ripple current
5.	BOM Count	9	General	Total Design BOM count
6.	FootPrint	134.0 mm^2	General	Total Foot Print Area of BOM components
7.	Frequency	2.1 MHz	General	Switching frequency
8.	Pout	12.5 W	General	Total output power
9.	Total BOM	$2.46	General	Total BOM Cost
10.	ICThetaJA Effective	18.0 degC/W	Op_Point	Effective IC Junction-to-Ambient Thermal Resistance
11.	Low Freq Gain	70.846 dB	Op_Point	Gain at 10Hz
12.	Vout Actual	5.014 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
13.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
14.	Cross Freq	76.069 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	26.869 %	Op_point	Duty cycle
16.	Efficiency	81.2 %	Op_point	Steady state efficiency
17.	Gain Marg	-21.631 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	79.584 degC	Op_point	IC junction temperature
19.	IOUT_OP	2.5 A	Op_point	Iout operating point
20.	Phase Marg	92.677 deg	Op_point	Bode Plot Phase Margin
21.	VIN_OP	20.0 V	Op_point	Vin operating point
22.	Vout p-p	2.258 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	2.488 mW	Power	Input capacitor power dissipation
24.	Cout Pd	118.196 µW	Power	Output capacitor power dissipation
25.	IC Iq Pd	100.0 µW	Power	IC Iq Pd
26.	IC Pd	2.756 W	Power	IC power dissipation
27.	L Pd	135.015 mW	Power	Inductor power dissipation
28.	Total Pd	2.894 W	Power	Total Power Dissipation
29.	Vout Tolerance	3.65 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.5	Maximum Output Current
2.	VinMax	20.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LMR23625CF	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LMR23625CF** Product Folder : http://www.ti.com/product/LMR23625 : contains the data sheet and other resources.