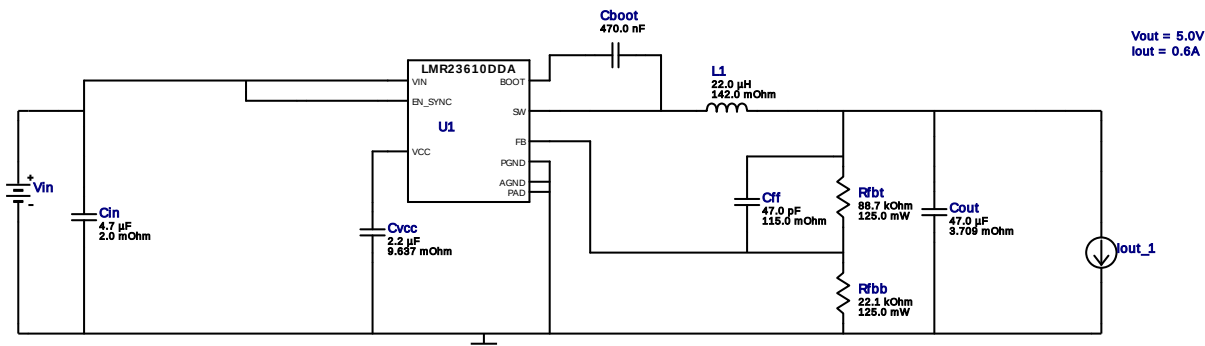


WEBENCH® Design Report

Design : 4743458/25 LMR23610ADDAR
LMR23610ADDAR 14.0V-22.0V to 5.00V @ 0.6A

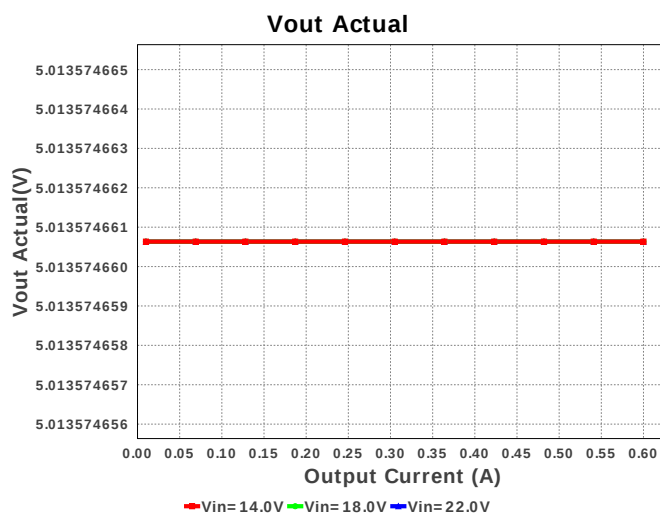
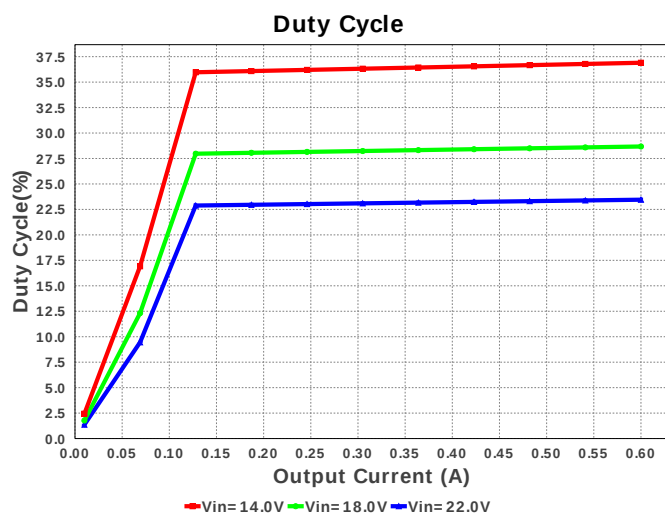
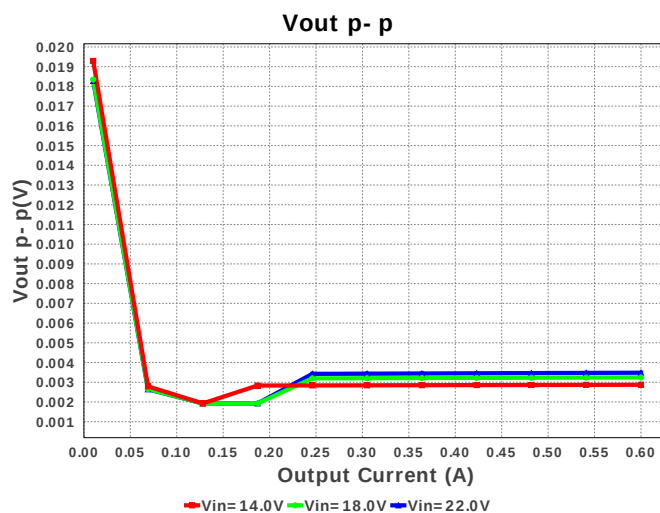
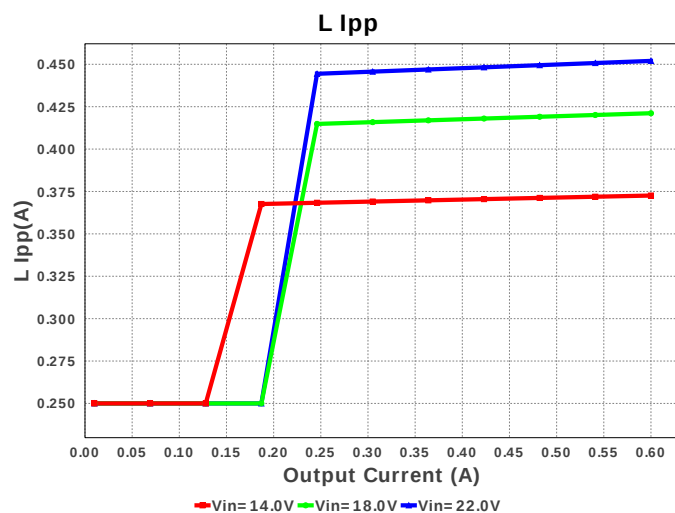


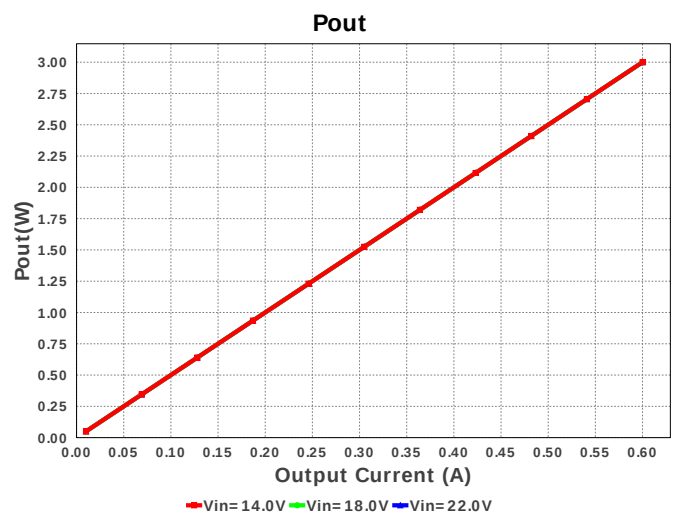
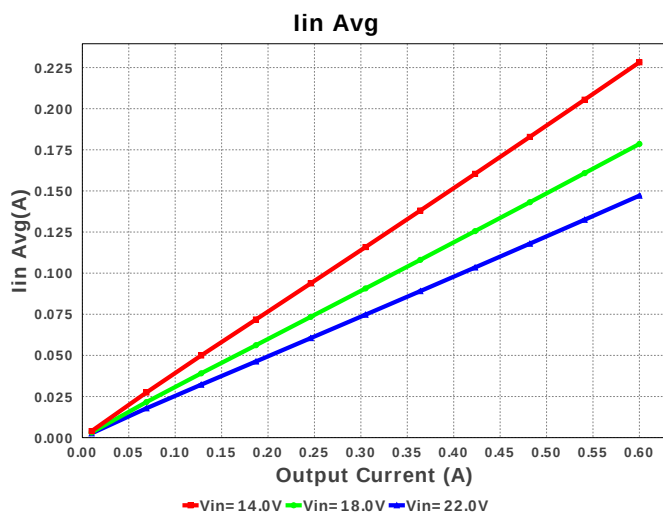
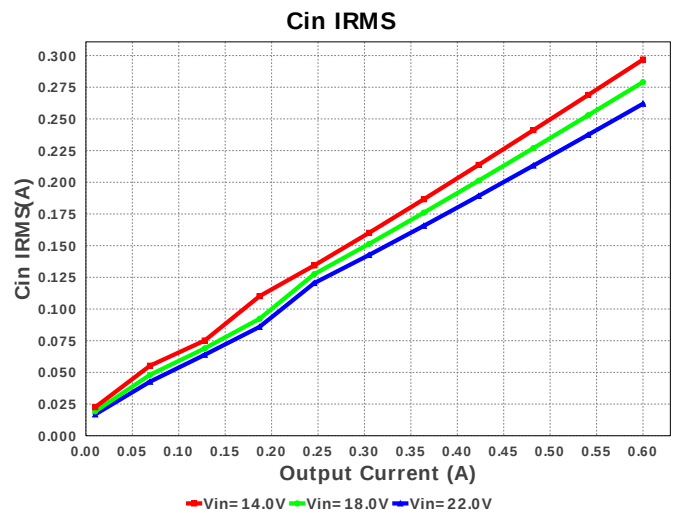
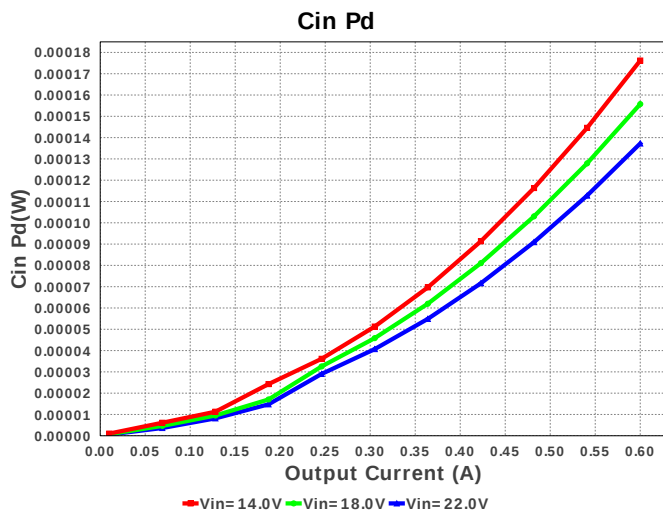
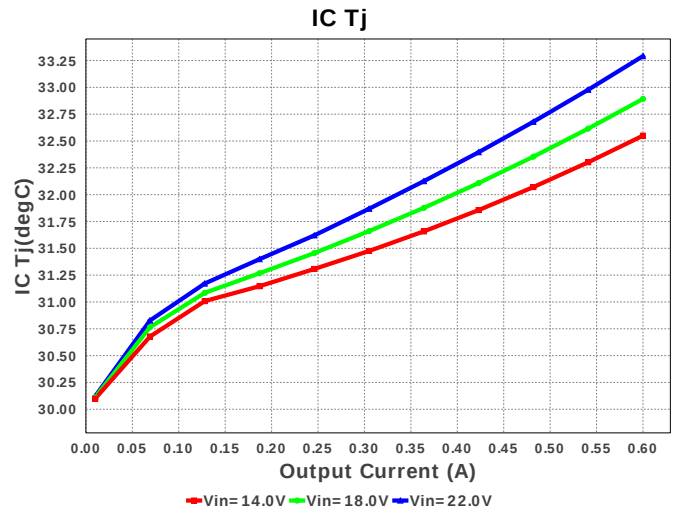
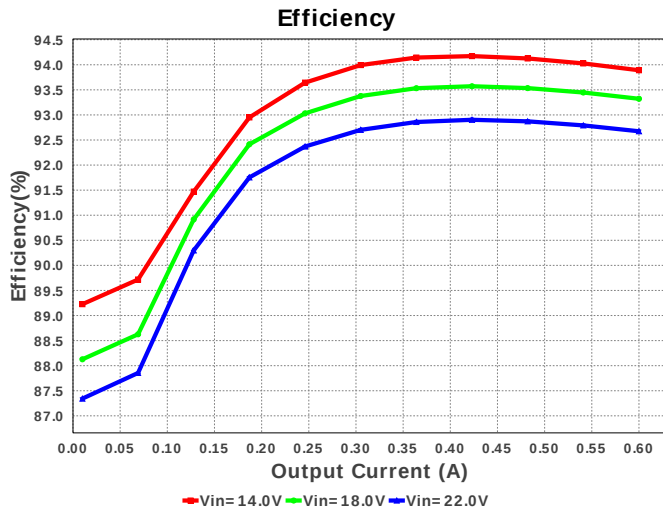
1. The input capacitor included in the BOM only contains a small filter capacitor that should be placed near the IC. Depending on where the power supply is laid out in the system additional bulk capacitance may need to be added to filter the line ripple.
2. If there is no VinTyp specified, WEBENCH will 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.

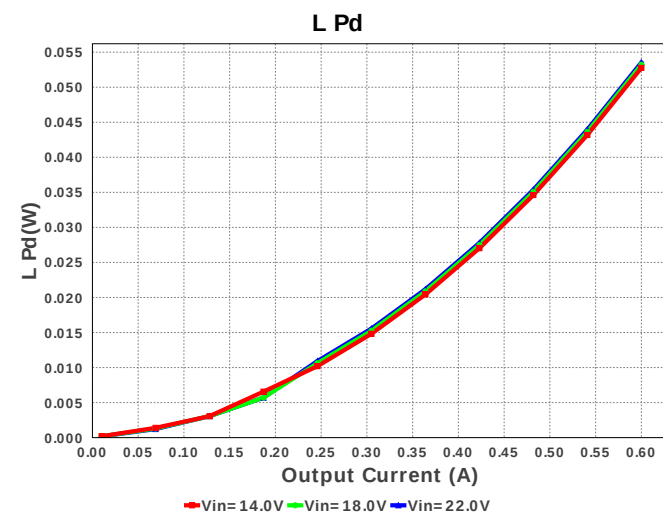
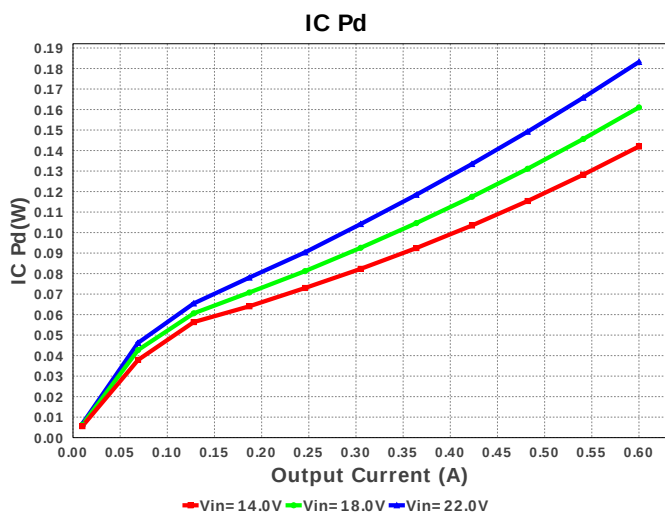
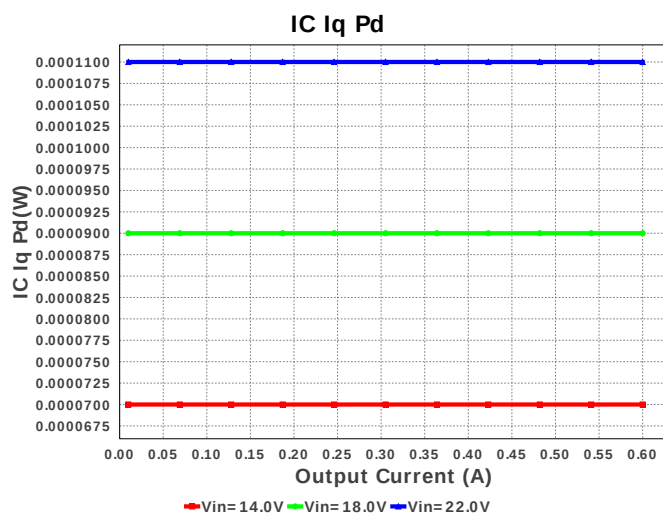
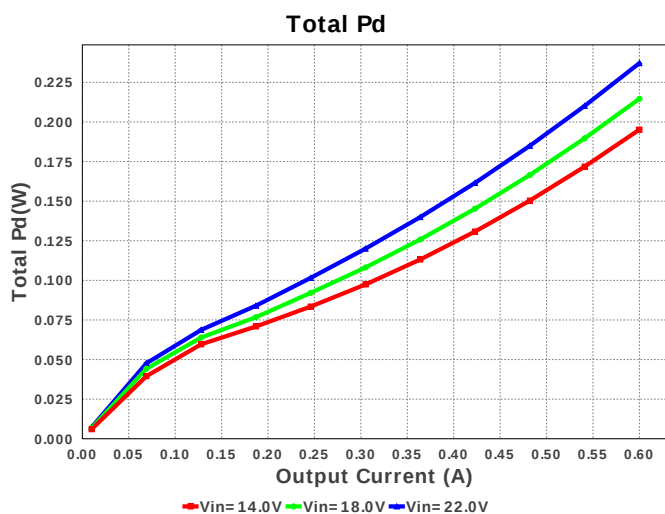
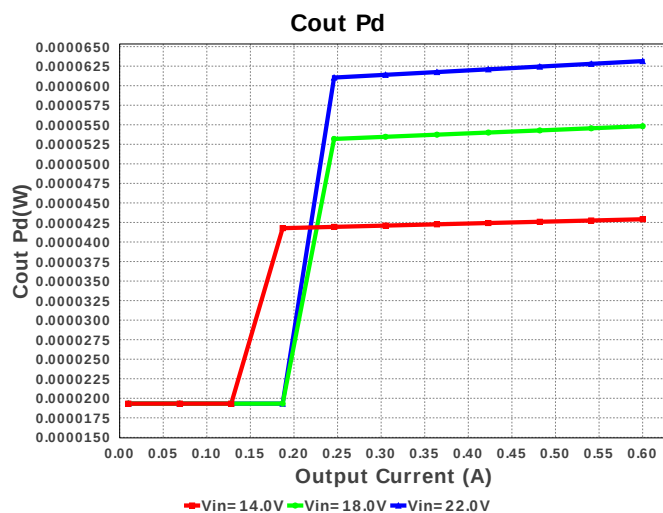
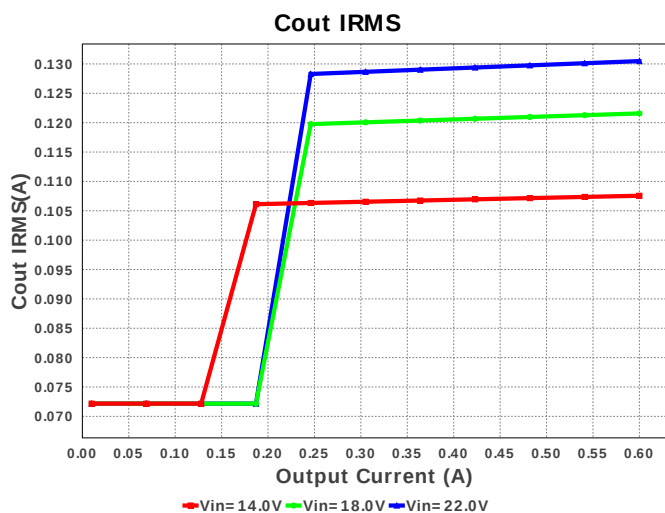
Electrical BOM

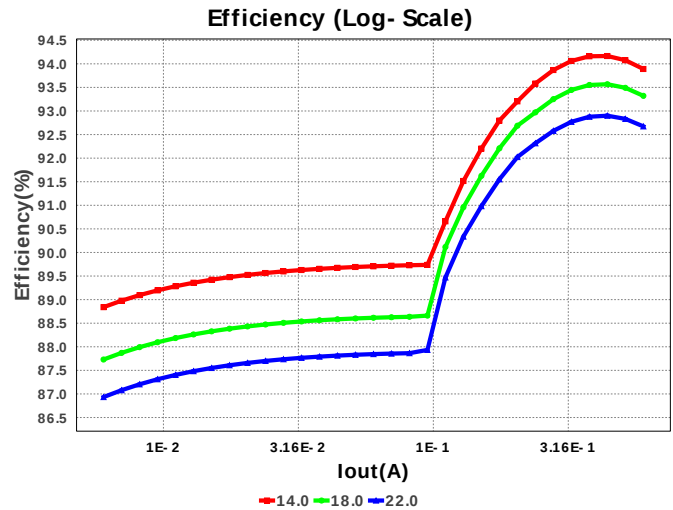
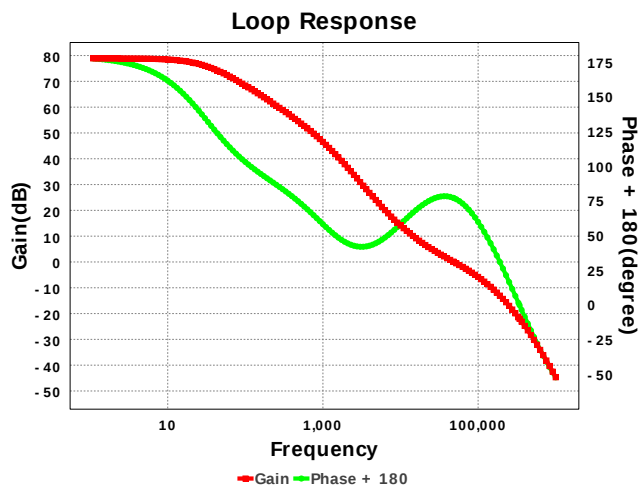
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Taiyo Yuden	GMK212BJ474KG-T Series= X5R	Cap= 470.0 nF VDC= 35.0 V IRMS= 0.0 A	1	\$0.03	 0805 7 mm ²
2.	Cff	Kemet	C0805C470J5GACTU Series= C0G/NP0	Cap= 47.0 pF ESR= 115.0 mOhm VDC= 50.0 V IRMS= 505.0 mA	1	\$0.01	 0805 7 mm ²
3.	Cin	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 mm ²
4.	Cout	MuRata	GRM31CR61A476KE15L Series= X5R	Cap= 47.0 uF ESR= 3.709 mOhm VDC= 10.0 V IRMS= 4.2862 A	1	\$0.15	 1206_190 11 mm ²
5.	Cvcc	MuRata	GRM188R60J225KE19D Series= X5R	Cap= 2.2 uF ESR= 9.637 mOhm VDC= 6.3 V IRMS= 1.32271 A	1	\$0.02	 0603 5 mm ²
6.	L1	Bourns	SRN6045-220M	L= 22.0 uH DCR= 142.0 mOhm	1	\$0.16	 SRN6045 64 mm ²
7.	Rfbb	Panasonic	ERJ-6ENF2212V Series= ERJ-6E	Res= 22.1 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
8.	Rfbb	Panasonic	ERJ-6ENF8872V Series= ERJ-6E	Res= 88.7 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	U1	Texas Instruments	LMR23610ADDAR	Switcher	1	\$1.30	 DDA0008E_N 57 mm²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	261.957 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	130.482 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	147.13 mA	Current	Average input current
4.	L Ipp	452.0 mA	Current	Peak-to-peak inductor ripple current
5.	BOM Count	9	General	Total Design BOM count
6.	FootPrint	179.0 mm ²	General	Total Foot Print Area of BOM components
7.	Frequency	400.0 kHz	General	Switching frequency
8.	Pout	3.0 W	General	Total output power
9.	Total BOM	\$1.88	General	Total BOM Cost
10.	ICThetaJA Effective	18.0 degC/W	Op_Point	Effective IC Junction-to-Ambient Thermal Resistance
11.	Low Freq Gain	78.88 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	48.797 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	23.453 %	Op_point	Duty cycle
16.	Efficiency	92.674 %	Op_point	Steady state efficiency
17.	Gain Marg	-22.042 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	33.291 degC	Op_point	IC junction temperature
19.	IOUT_OP	600.0 mA	Op_point	Iout operating point
20.	Phase Marg	77.234 deg	Op_point	Bode Plot Phase Margin
21.	VIN_OP	22.0 V	Op_point	Vin operating point
22.	Vout p-p	3.484 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	137.243 μW	Power	Input capacitor power dissipation
24.	Cout Pd	63.147 μW	Power	Output capacitor power dissipation
25.	IC Iq Pd	110.0 μW	Power	IC Iq Pd
26.	IC Pd	183.202 mW	Power	IC power dissipation
27.	L Pd	53.538 mW	Power	Inductor power dissipation
28.	Total Pd	237.132 mW	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	600.0 m	Maximum Output Current
2.	VinMax	22.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LMR23610A	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LMR23610A** Product Folder : <http://www.ti.com/product/LMR23610> : contains the data sheet and other resources.

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