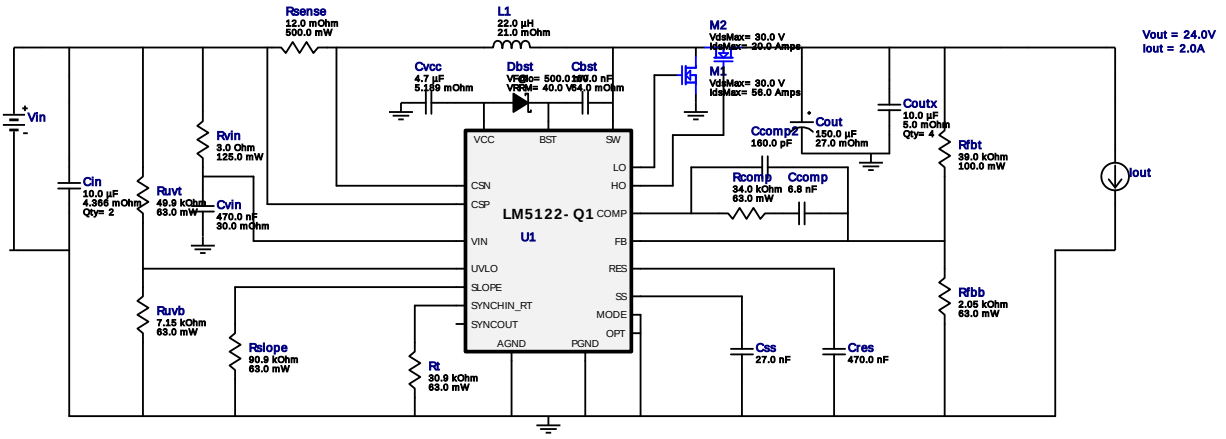
WEBENCH® Design Report

VinMin = 11.0V
VinMax = 14.0V
Vout = 24.0V
Iout = 2.0A

Device = LM5122QMH/NOPB
Topology = Boost
Created = 9/2/16 5:08:15 AM
BOM Cost = $0.00
BOM Count = 28
Total Pd = 2.01W

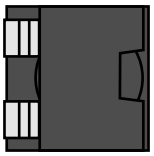
Design : 3788821/368 LM5122QMH/NOPB
LM5122QMH/NOPB 11.0V-14.0V to 24.03V @ 2.0A

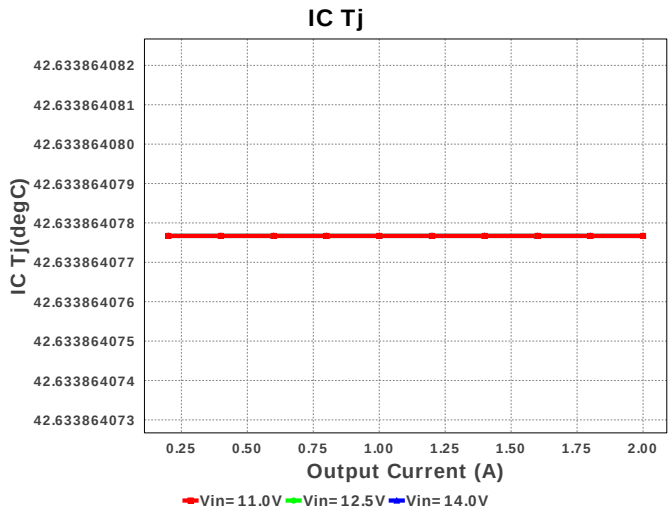


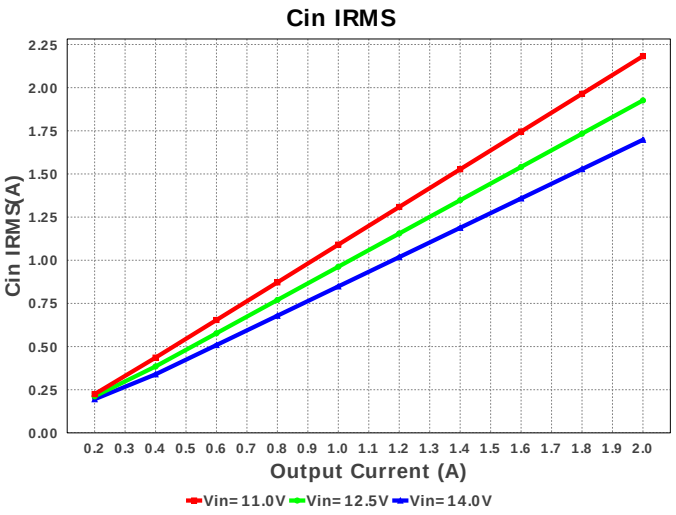
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

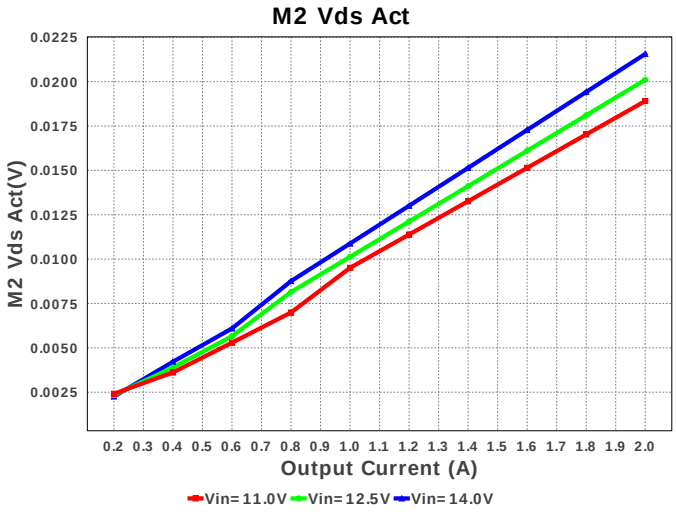
Electrical BOM

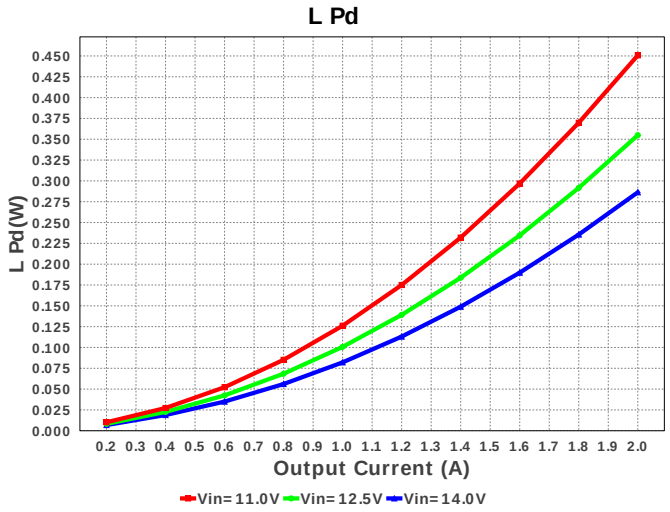
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
2.	Ccomp	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Samsung Electro-Mechanics	CL21C161JBANNNC Series= C0G/NP0	Cap= 160.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	MuRata	GRM31CR71E106KA12L Series= X7R	Cap= 10.0 uF ESR= 4.366 mOhm VDC= 25.0 V IRMS= 2.8022 A	2	$0.05	1206_190 11 mm²
5.	Cout	Panasonic	EEHZA1V151P Series= ?	Cap= 150.0 uF ESR= 27.0 mOhm VDC= 35.0 V IRMS= 2.3 A	1	$0.96	SM_RADIAL_8MM 113 mm²
6.	Coutx	TDK	C5750X7S2A106M230KB Series= X7S	Cap= 10.0 uF ESR= 5.0 mOhm VDC= 100.0 V IRMS= 6.45 A	4	NA	2220 54 mm²
7.	Cres	Taiyo Yuden	TMK212BJ474KD-T Series= X5R	Cap= 470.0 nF VDC= 20.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
8.	Css	MuRata	GRM155R61A273KA01D Series= X5R	Cap= 27.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
9.	Cvcc	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 5.189 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	$0.02	0805 7 mm²

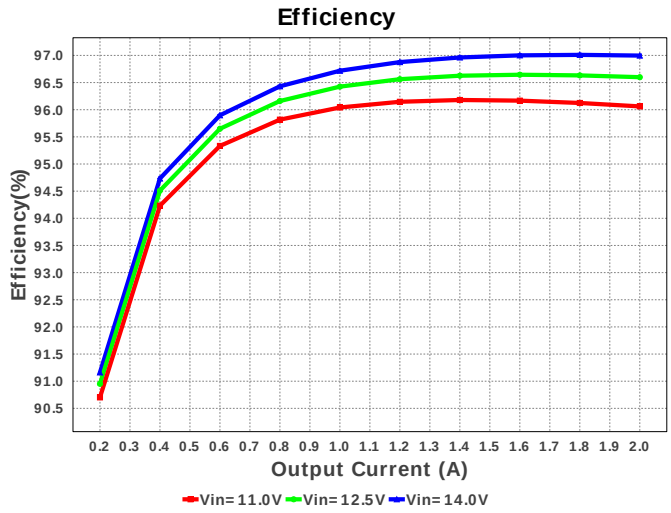
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cvin	MuRata	GRM188R71E474KA12D Series= X7R	Cap= 470.0 nF ESR= 30.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.02	 0603 5 mm²
11.	Dbst	Vishay-Semiconductor	SS14-E3/61T	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.08	 SMA 37 mm²
12.	L1	Coilcraft	SER1390-223MLB	L= 22.0 µH DCR= 21.0 mOhm	1	$0.95	 SER1390 240 mm²
13.	M1	Texas Instruments	CSD17304Q3	VdsMax= 30.0 V IdsMax= 56.0 Amps	1	$0.32	 DQG0008A 18 mm²
14.	M2	Texas Instruments	CSD17578Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	$0.21	 DNH0008A 18 mm²
15.	Rcomp	Vishay-Dale	CRCW040234K0FKED Series= CRCW..e3	Res= 34.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
16.	Rfbb	Vishay-Dale	CRCW04022K05FKED Series= CRCW..e3	Res= 2.05 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
17.	Rfbt	Yageo America	RC0603FR-0739KL Series= ?	Res= 39.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
18.	Rsense	Stackpole Electronics Inc	CSR1206FK12L0 Series= ?	Res= 12.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	 1206 11 mm²
19.	Rslope	Vishay-Dale	CRCW040290K9FKED Series= CRCW..e3	Res= 90.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
20.	Rt	Vishay-Dale	CRCW040230K9FKED Series= CRCW..e3	Res= 30.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Ruvb	Vishay-Dale	CRCW04027K15FKED Series= CRCW..e3	Res= 7.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
22.	Ruvt	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
23.	Rvin	Yageo America	RC0805FR-073RL Series= ?	Res= 3.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
24.	U1	Texas Instruments	LM5122QMH/NOPB	Switcher	1	$2.46	 MXA20A 71 mm²

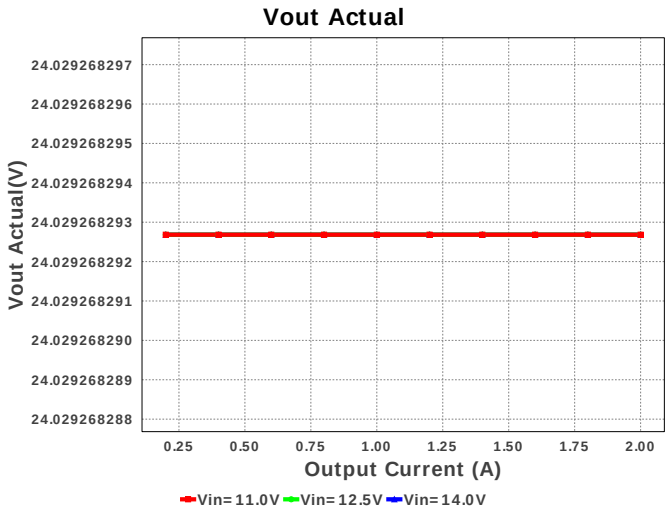


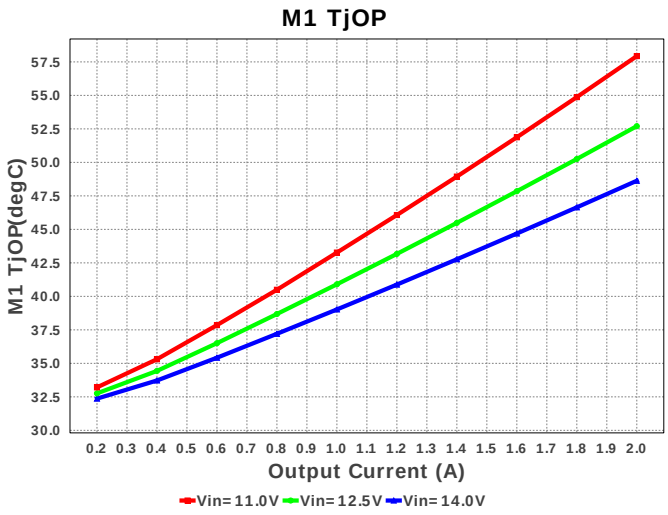


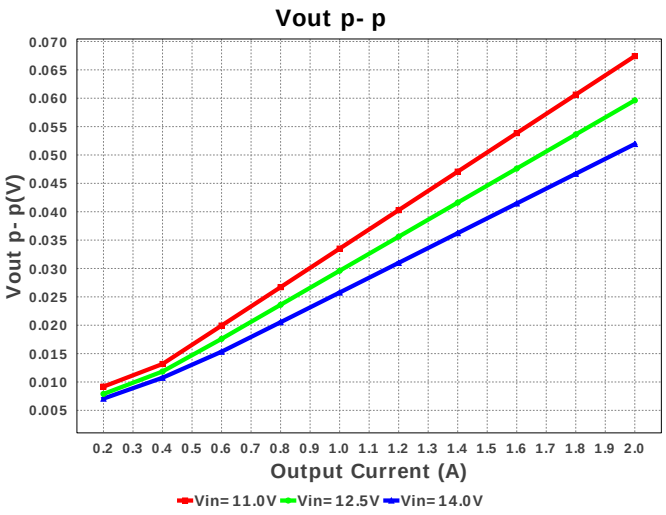


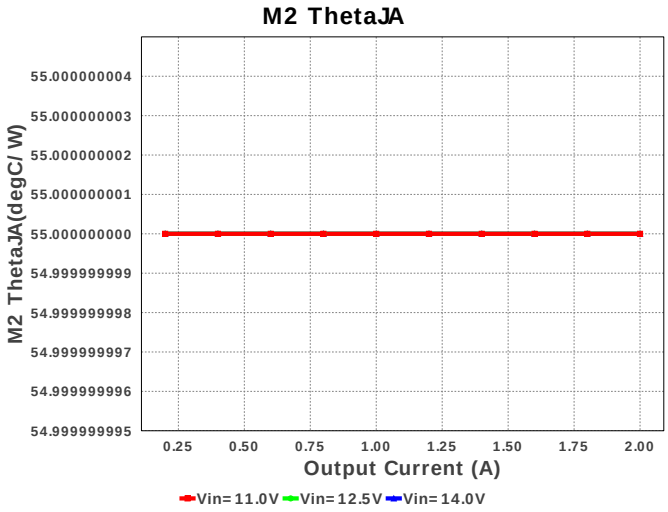


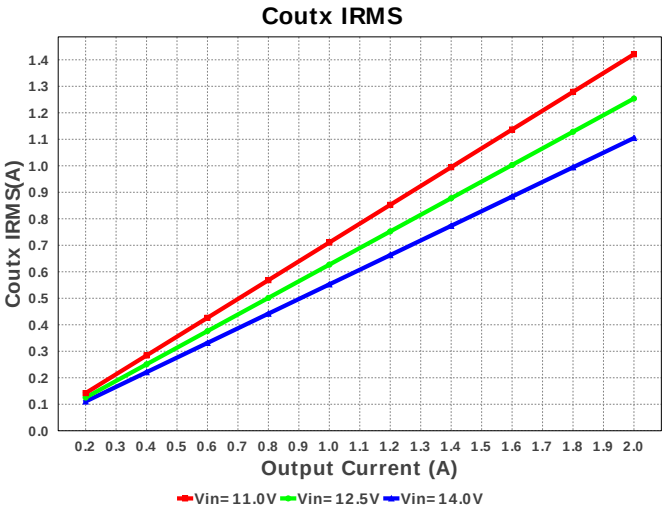


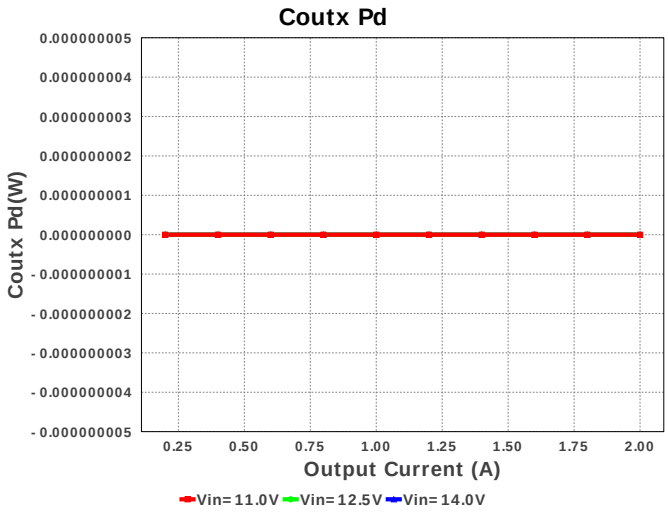


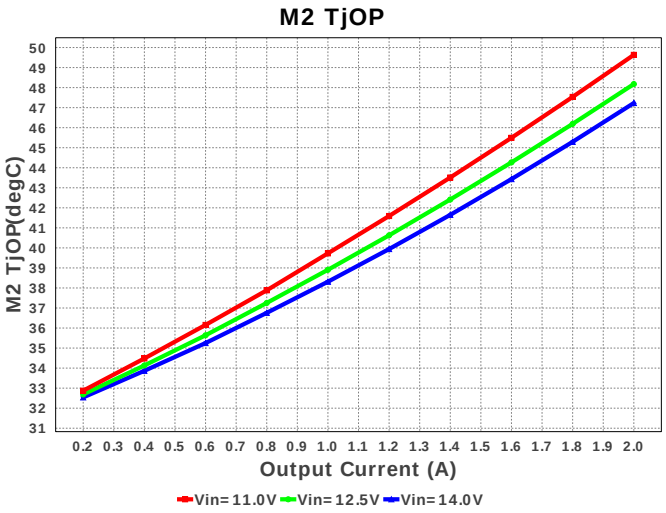


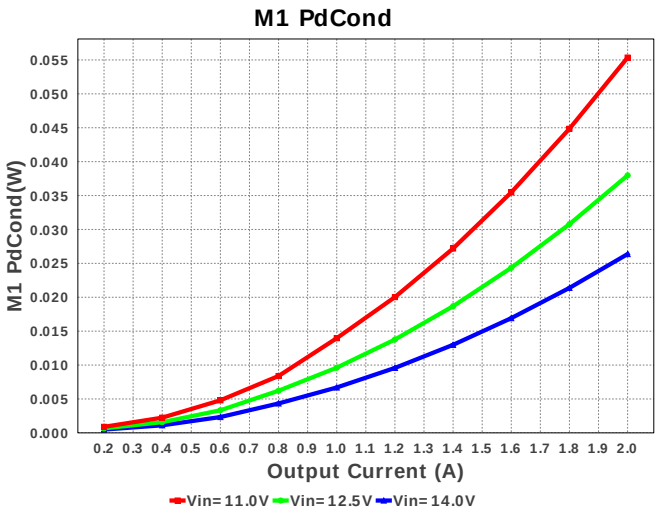


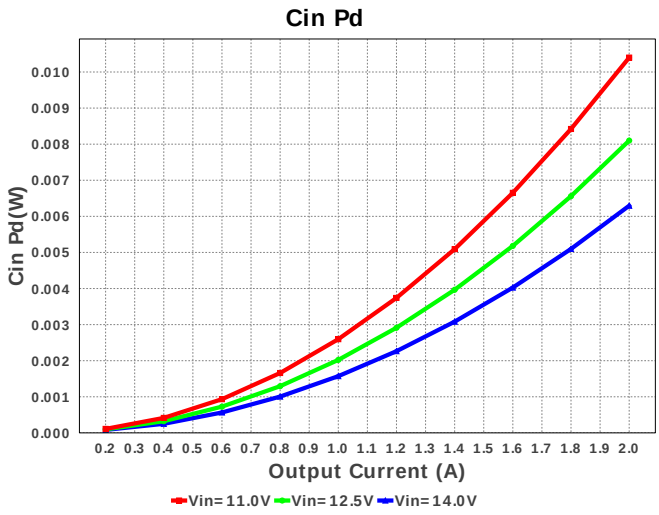


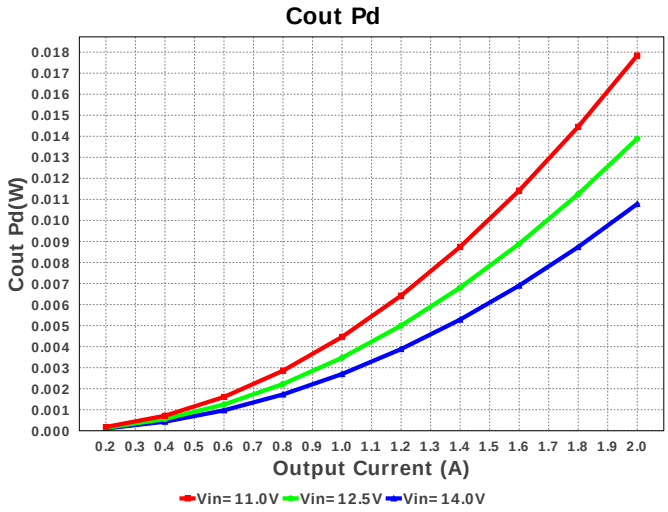


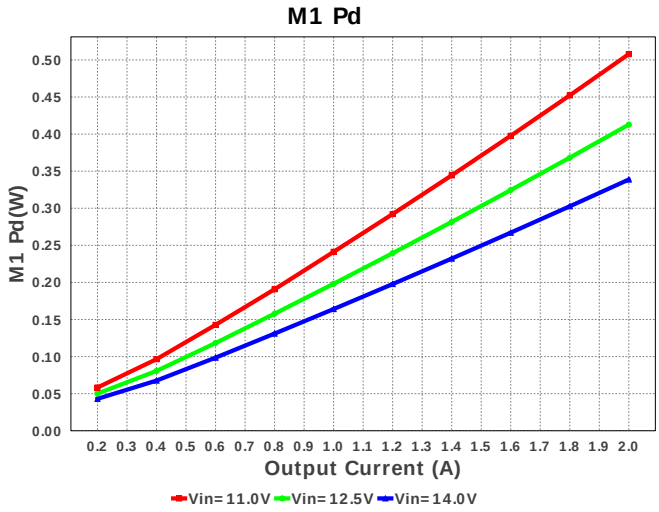


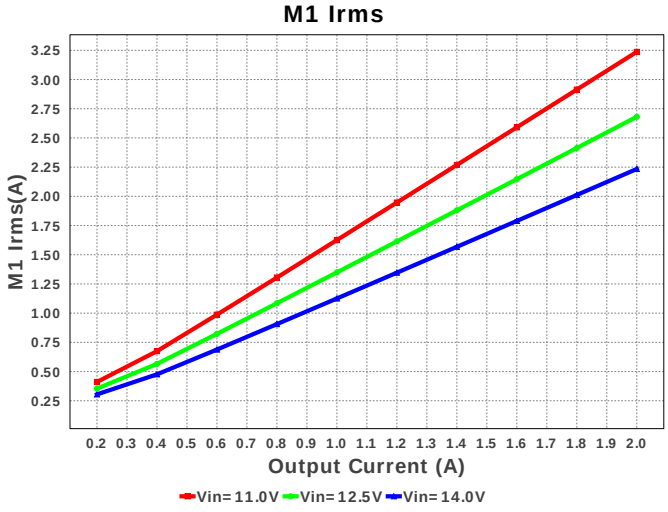


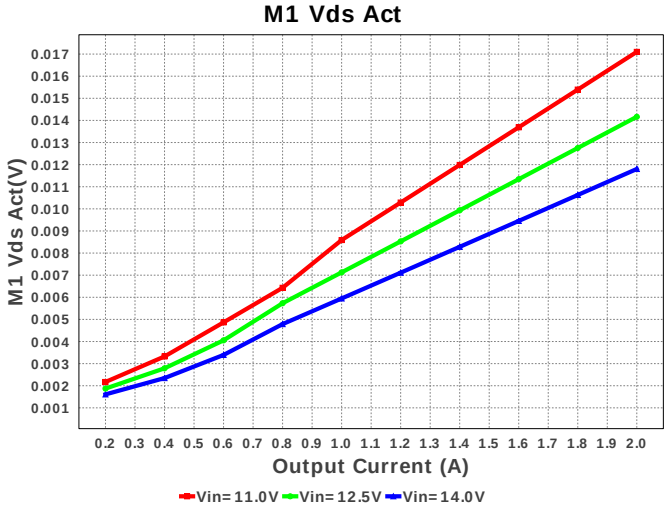


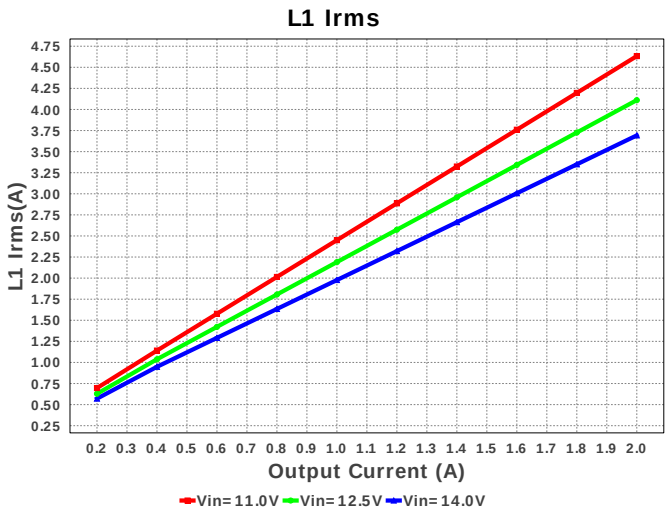


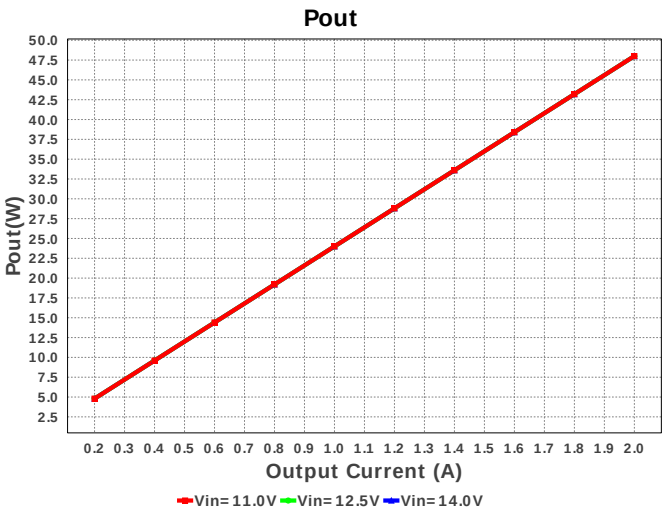


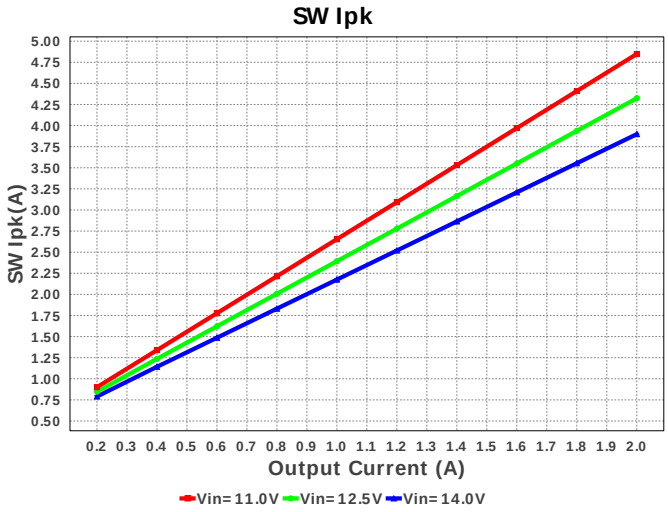


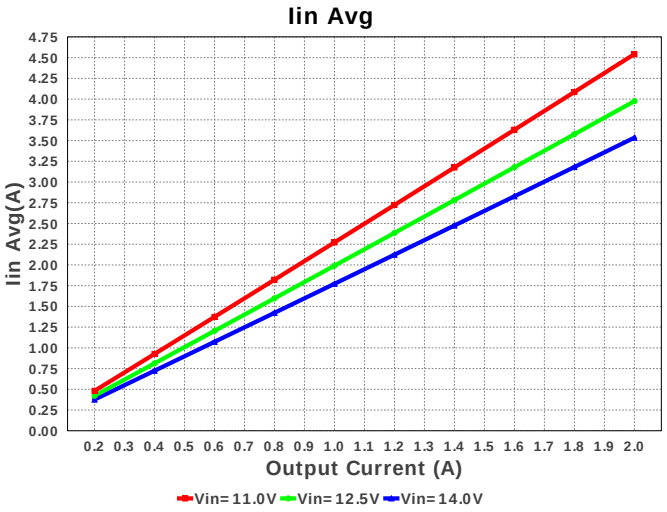


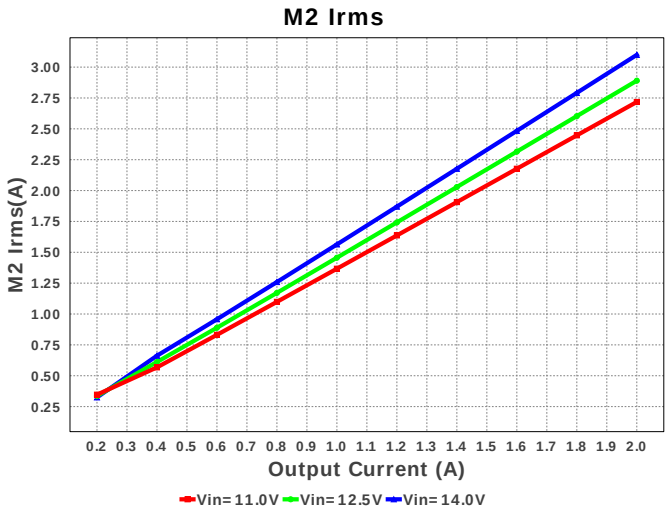


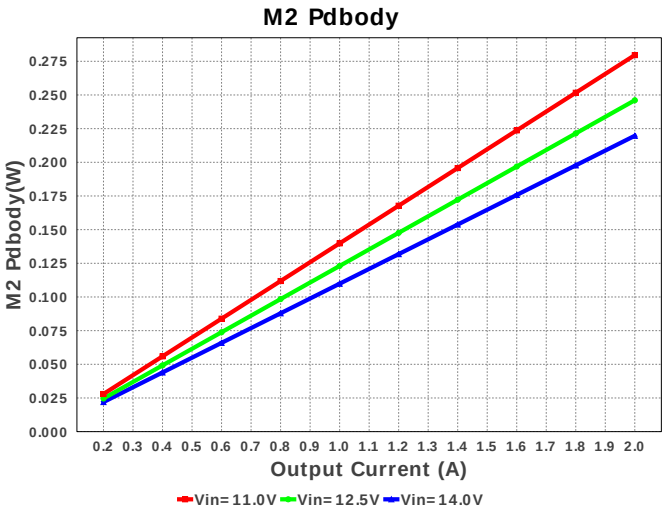


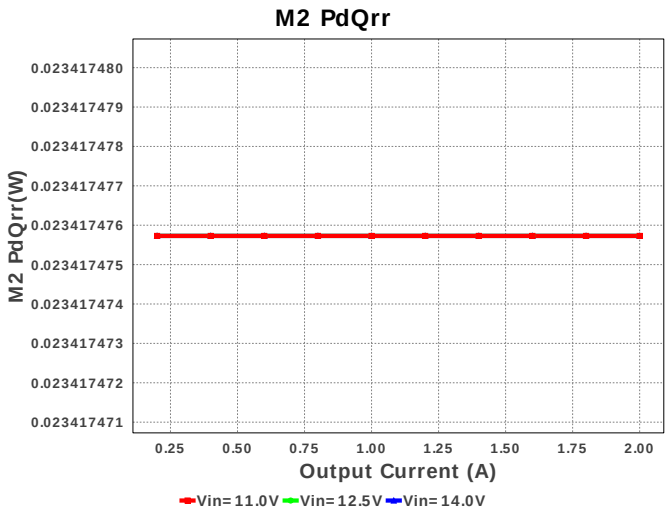


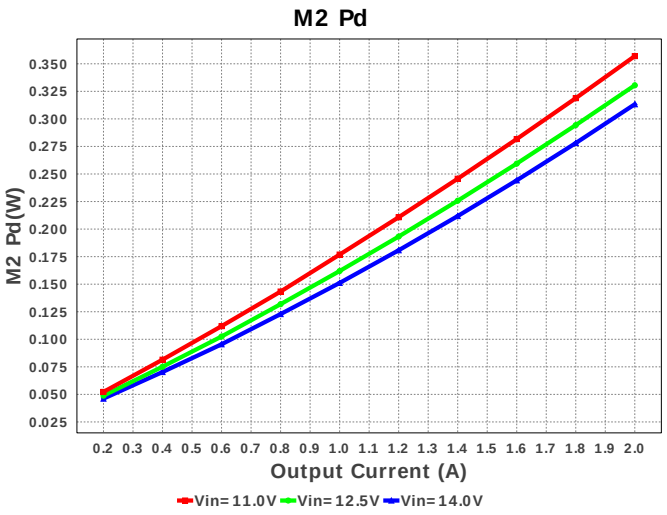


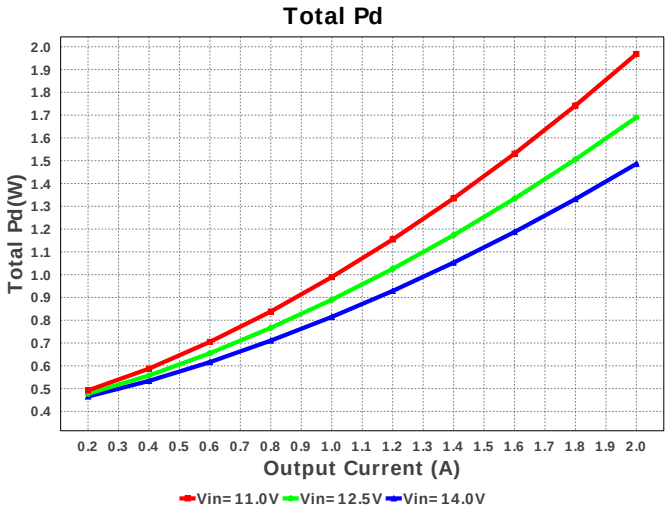


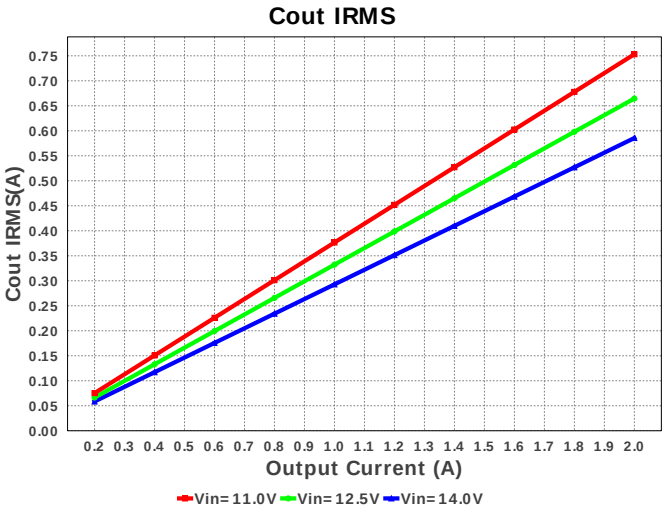


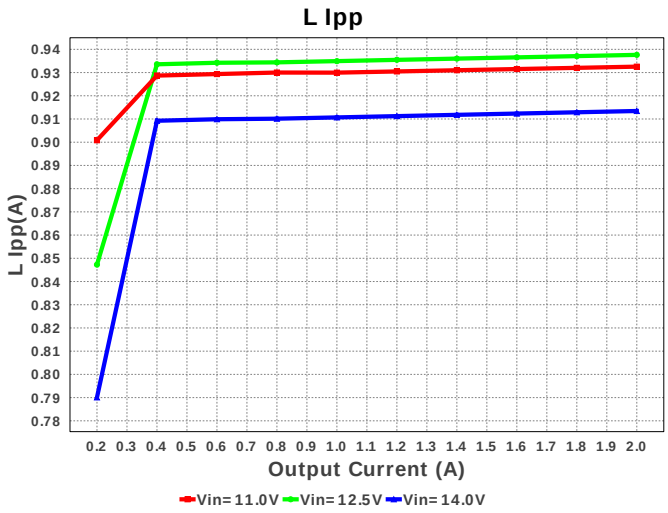


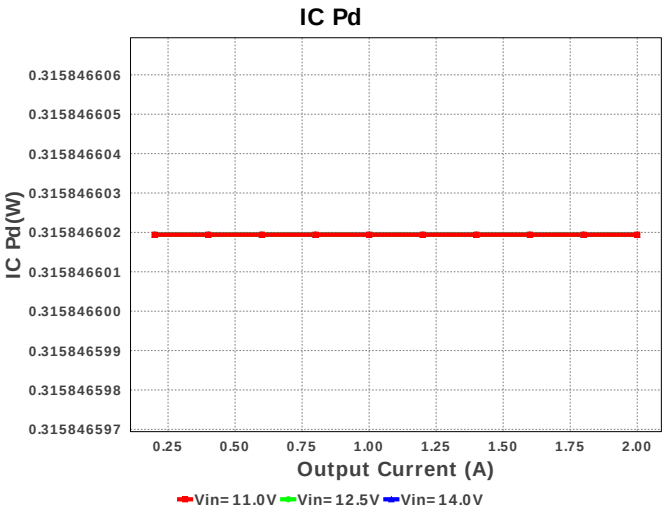


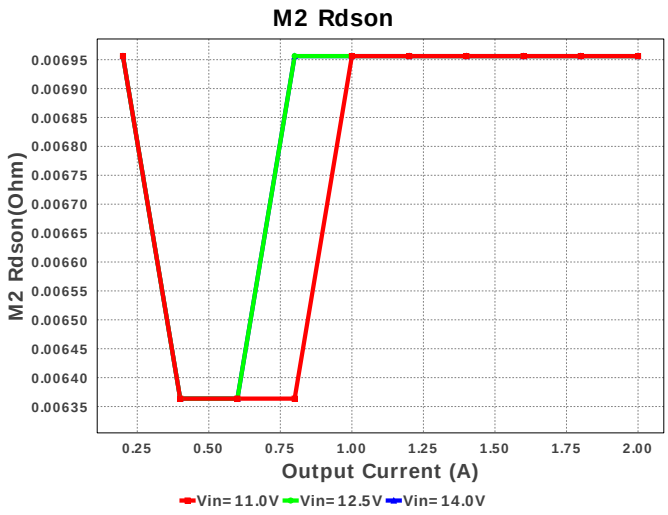


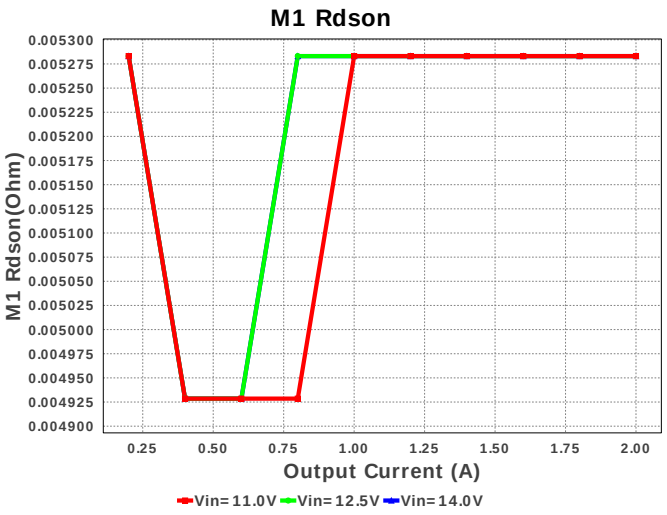


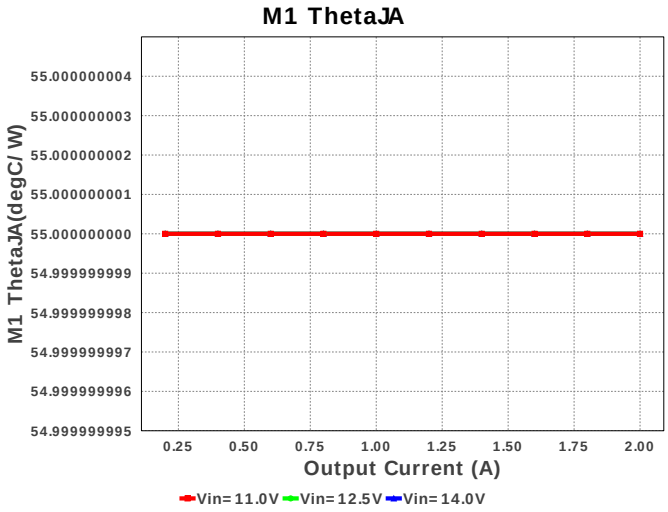


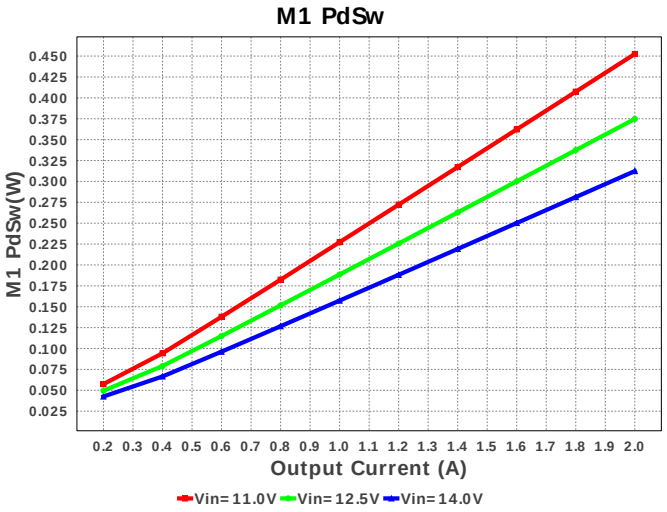


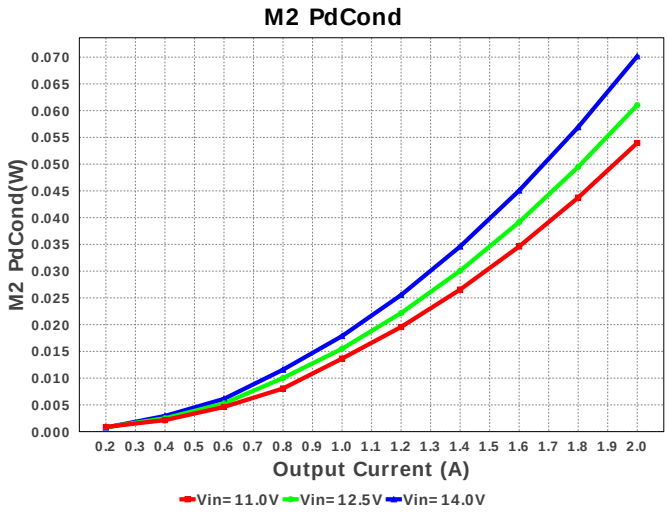


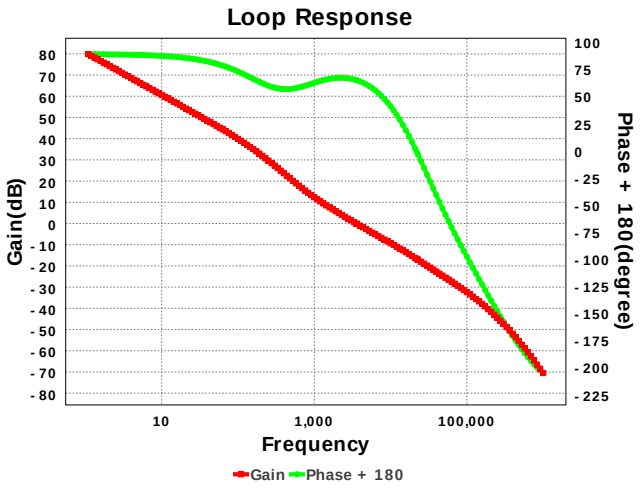












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.183 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	728.124 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	1.446 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	4.546 A	Current	Average input current
5.	L Ipp	932.54 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	4.633 A	Current	Inductor ripple current
7.	M1 Irms	3.237 A	Current	MOSFET RMS ripple current
8.	M2 Irms	2.718 A	Current	MOSFET RMS ripple current
9.	SW Ipk	4.848 A	Current	Peak switch current
10.	BOM Count	28	General	Total Design BOM count
11.	FootPrint	818.0 mm^2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Frequency	291.262 kHz	General	Switching frequency
13.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
14.	M1 Rdson	5.312 mOhm	General	Drain-Source On-resistance
15.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	M2 Rdson	7.005 mOhm	General	Drain-Source On-resistance
17.	M2 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
18.	M2 Vds Act	19.038 mV	General	M Vds
19.	Mode	CCM	General	Conduction Mode
20.	Pout	48.0 W	General	Total output power
21.	Total BOM	$0.0	General	Total BOM Cost
22.	Low Freq Gain	79.577 dB	Op_Point	Gain at 10Hz
23.	Vout Actual	24.029 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
24.	Vout OP	24.029 V	Op_Point	Operational Output Voltage
25.	Cross Freq	2.827 kHz	Op_point	Bode plot crossover frequency
26.	Efficiency	95.99 %	Op_point	Steady state efficiency
27.	Gain Marg	-15.413 dB	Op_point	Bode Plot Gain Margin
28.	IC Tj	44.088 degC	Op_point	IC junction temperature
29.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
30.	IOUT_OP	2.0 A	Op_point	Iout operating point
31.	M1 TjOP	57.949 degC	Op_point	M1 MOSFET junction temperature
32.	M2 TjOP	49.655 degC	Op_point	MOSFET junction temperature
33.	Phase Marg	64.824 deg	Op_point	Bode Plot Phase Margin
34.	VIN_OP	11.0 V	Op_point	Vin operating point
35.	Vout p-p	65.319 mV	Op_point	Peak-to-peak output ripple voltage
36.	Cin Pd	10.399 mW	Power	Input capacitor power dissipation
37.	Cout Pd	16.928 mW	Power	Output capacitor power dissipation
38.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
39.	IC Pd	352.196 mW	Power	IC power dissipation
40.	L Pd	450.727 mW	Power	Inductor power dissipation
41.	M1 Pd	508.171 mW	Power	MOSFET power dissipation
42.	M1 PdCond	55.655 mW	Power	M1 MOSFET conduction losses
43.	M1 PdSw	452.516 mW	Power	M1 MOSFET switching losses
44.	M2 Pd	357.359 mW	Power	MOSFET power dissipation
45.	M2 PdCond	54.33 mW	Power	M2 MOSFET conduction losses
46.	M2 PdQrr	23.417 mW	Power	Synchronous Boost High Side Reverse Recovery
47.	M2 Pdbody	279.612 mW	Power	Power dissipation through lower FET
48.	Total Pd	2.005 W	Power	Total Power Dissipation
49.	M1 Vds Act	17.195 mV		M Vds
50.	Vout Tolerance	3.448 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	11.0	Minimum input voltage
4.	Vout	24.0	Output Voltage
5.	base_pn	LM5122-Q1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. The LM5122 is a wide range boost controller which is operable in an ultra wide input range of 4.5 to 65V. A boost regulator can maintain regulation for input voltages lower than the output voltage.

2. Feature Highlights: Automotive Qualified 12V to 14V Vin, 24Vout, 2A as typical design input conditions

3. The LM5122-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application

4. **LM5122-Q1** Product Folder : http://www.ti.com/product/LM5122%2DQ1 : contains the data sheet and other resources.