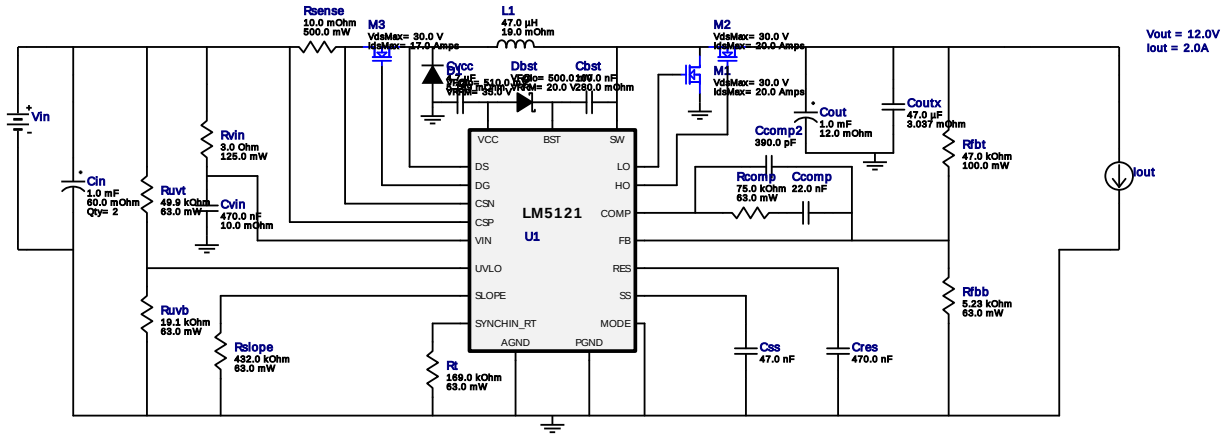
TEXAS INSTRUMENTS

WEBENCH® Design Report

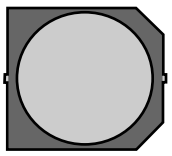
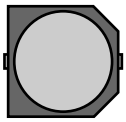
VinMin = 5.0V
VinMax = 12.0V
Vout = 12.0V
Iout = 2.0A

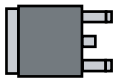
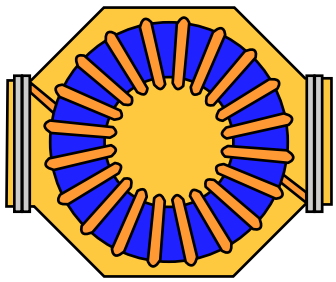
Device = LM5121MH/NOPB
Topology = Boost
Created = 8/11/16 8:00:33 AM
BOM Cost = $0.00
BOM Count = 27
Total Pd = 1.66W

Design : 4085315/13 LM5121MH/NOPB
LM5121MH/NOPB 5.0V-12.0V to 12.00V @ 2.0A

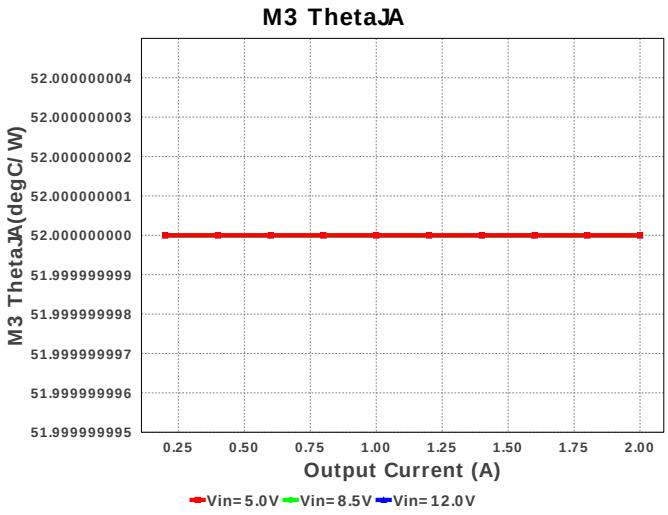


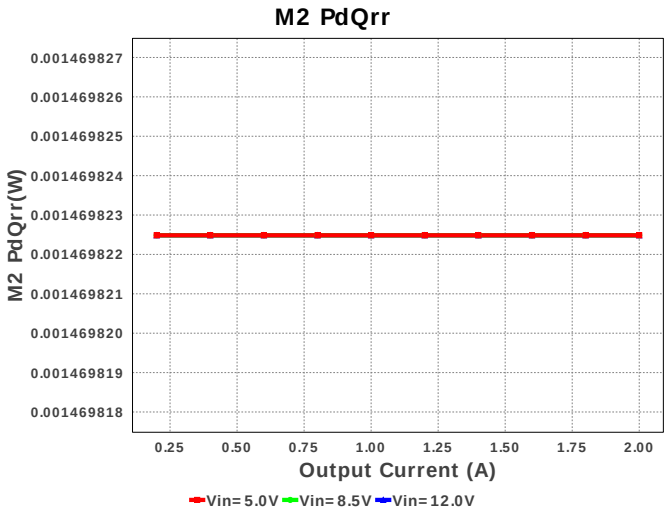
Electrical BOM

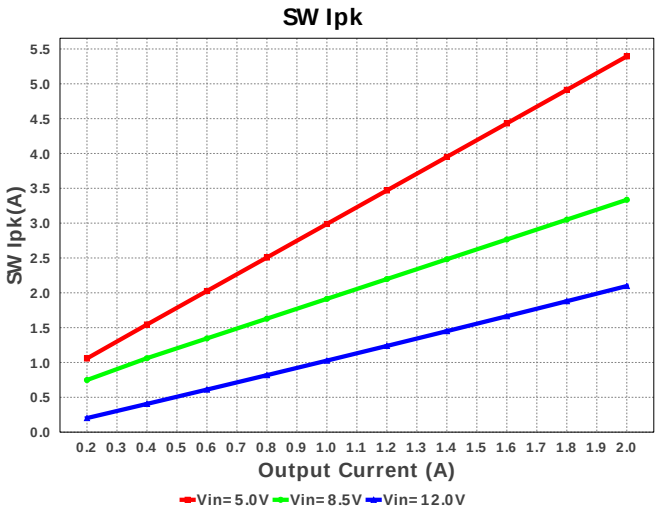
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB391 Series= X7R	Cap= 390.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	Panasonic	EEV-FK1E102Q Series= FK	Cap= 1.0 mF ESR= 60.0 mOhm VDC= 25.0 V IRMS= 1.1 A	2	$0.48	 SM_RADIAL_H13 264 mm²
5.	Cout	Panasonic	16SVPF1000M Series= ?	Cap= 1.0 mF ESR= 12.0 mOhm VDC= 16.0 V IRMS= 5.4 A	1	$0.74	 CAPSMT_62_F12 151 mm²
6.	Coutx	MuRata	GRM32ER61C476ME15L Series= X5R	Cap= 47.0 uF ESR= 3.037 mOhm VDC= 16.0 V IRMS= 4.59346 A	1	$0.24	1210_280 15 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	Taiyo Yuden	TMK212B7473KD-T Series= X7R	Cap= 47.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 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

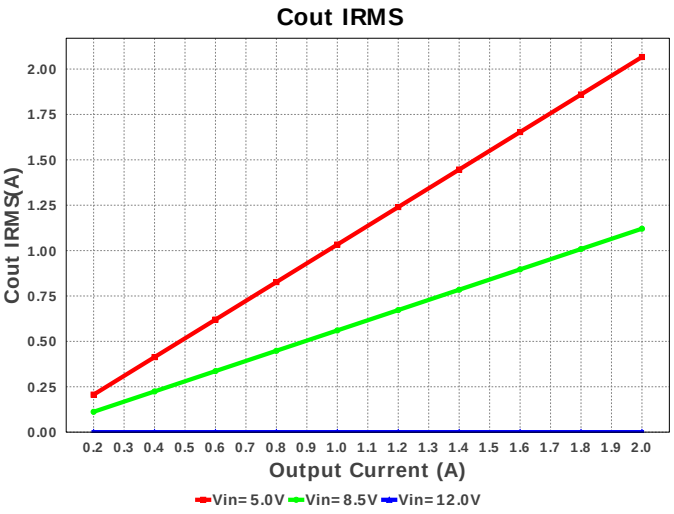
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cvin	MuRata	GRM188R71C474KA88D Series= X7R	Cap= 470.0 nF ESR= 10.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0603 5 mm^2
11.	D1	ON Semiconductor	MBRD835LT4G	VF@Io= 510.0 mV VRRM= 35.0 V	1	$0.25	 DPAK 102 mm^2
12.	Dbst	Vishay-Semiconductor	SS12-E3/61T	VF@Io= 500.0 mV VRRM= 20.0 V	1	$0.08	 SMA 37 mm^2
13.	L1	Bourns	PM2120-470K-RC	L= 47.0 µH DCR= 19.0 mOhm	1	$1.33	 PM2120 890 mm^2
14.	M1	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	$0.19	 TRANS_NexFET_Q3A 18 mm^2
15.	M2	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	$0.19	 TRANS_NexFET_Q3A 18 mm^2
16.	M3	Vishay-Siliconix	SI7636DP	VdsMax= 30.0 V IdsMax= 17.0 Amps	1	NA	 PowerPAK_SO-8 55 mm^2
17.	Rcomp	Vishay-Dale	CRCW040275K0FKED Series= CRCW..e3	Res= 75.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Rfbb	Vishay-Dale	CRCW04025K23FKED Series= CRCW..e3	Res= 5.23 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
19.	Rfbt	Yageo America	RC0603FR-0747KL Series= ?	Res= 47.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
20.	Rsense	Stackpole Electronics Inc	CSR1206FK10L0 Series= ?	Res= 10.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	 1206 11 mm^2
21.	Rslope	Vishay-Dale	CRCW0402432KFKED Series= CRCW..e3	Res= 432.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
22.	Rt	Vishay-Dale	CRCW0402169KFKED Series= CRCW..e3	Res= 169.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Ruvb	Vishay-Dale	CRCW040219K1FKED Series= CRCW..e3	Res= 19.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
24.	Ruvt	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
25.	Rvin	Yageo America	RC0805FR-073RL Series= ?	Res= 3.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2

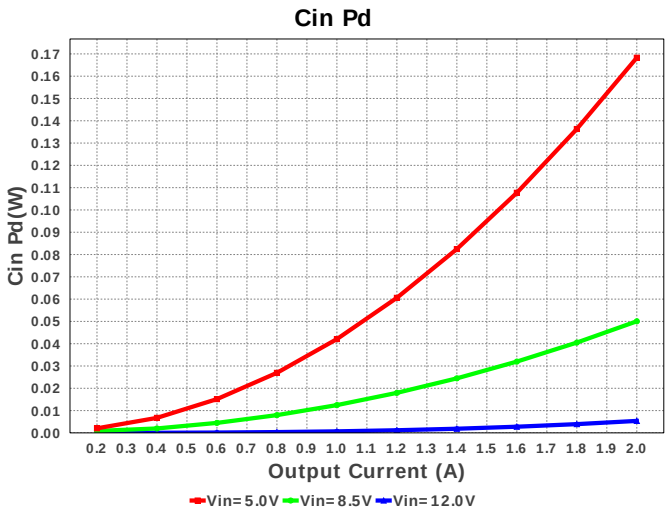
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	U1	Texas Instruments	LM5121MH/NOPB	Switcher	1	$2.46	 MXA20A 71 mm²

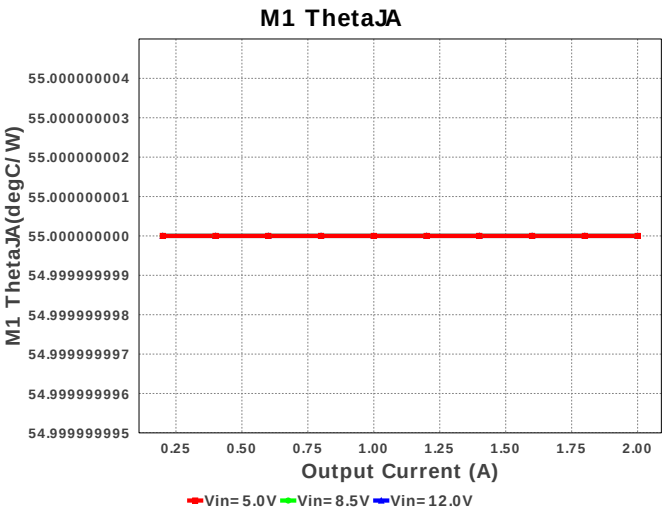


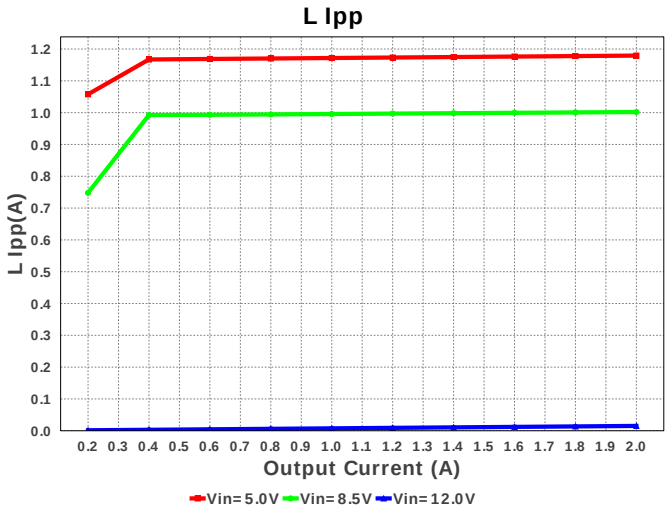


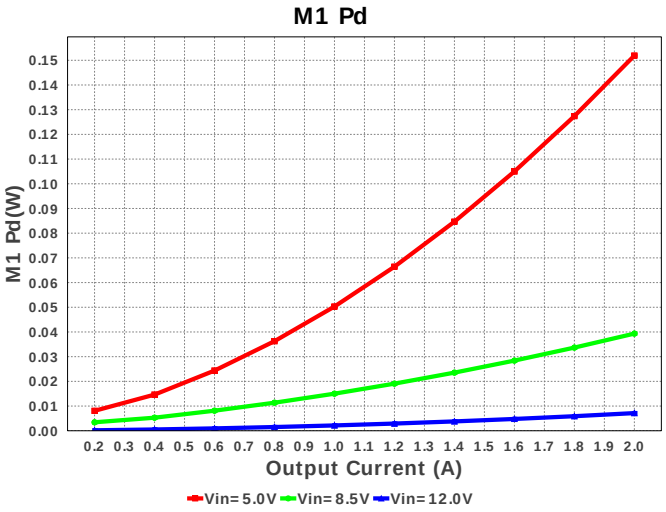


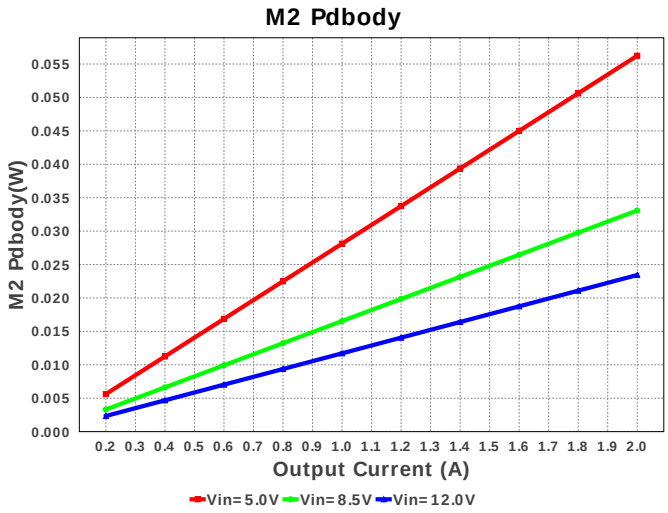


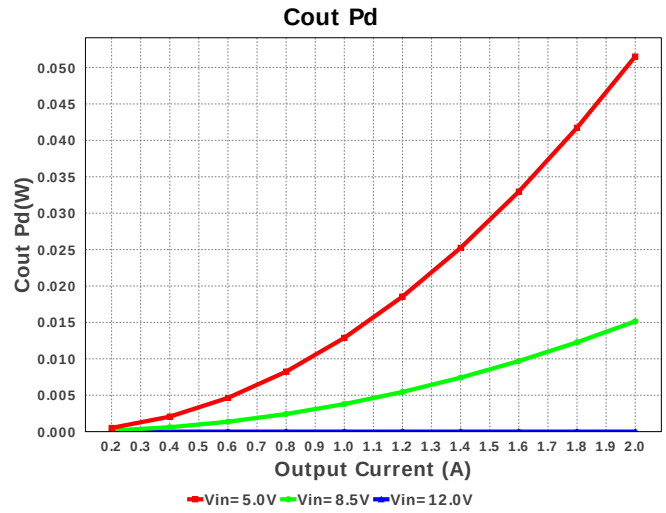


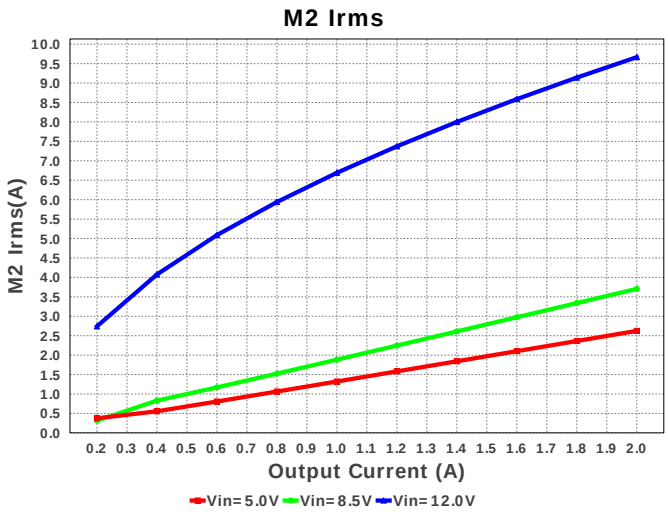


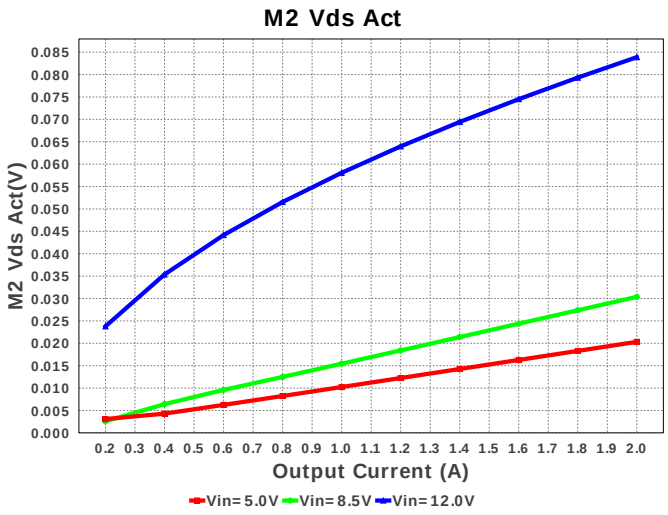


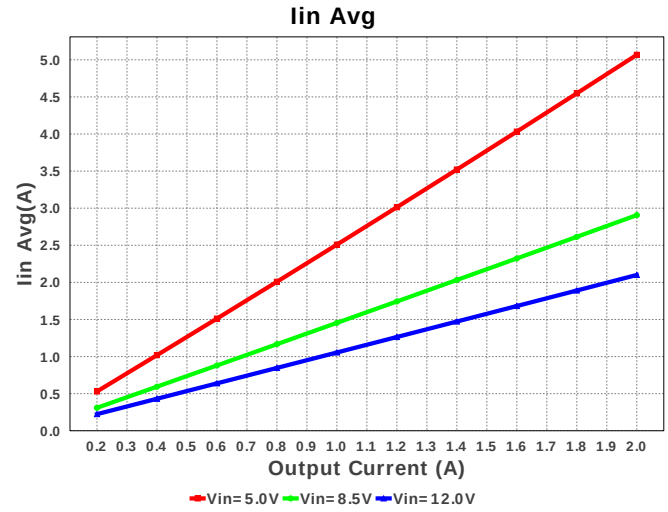


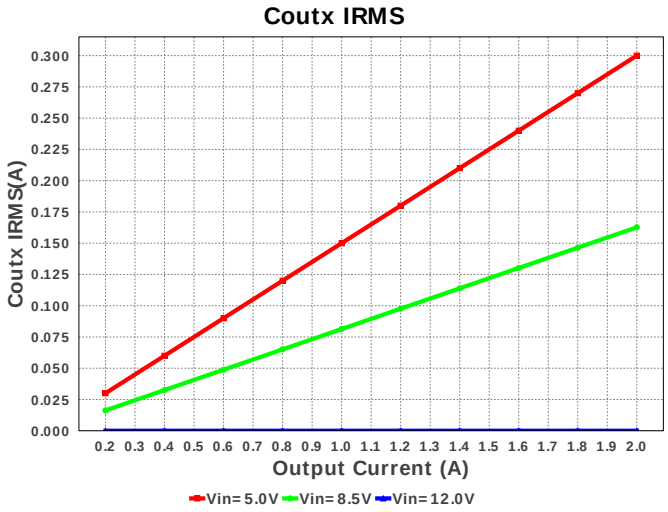


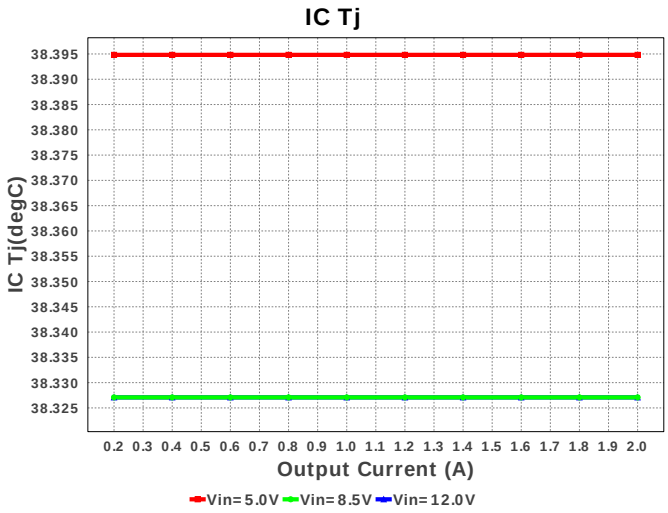


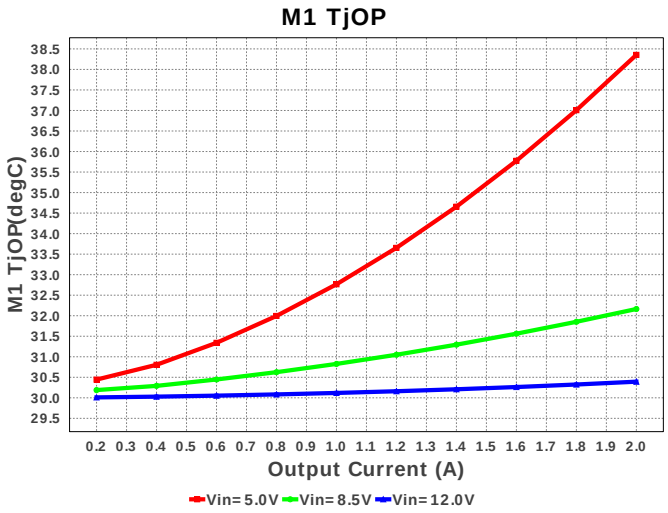


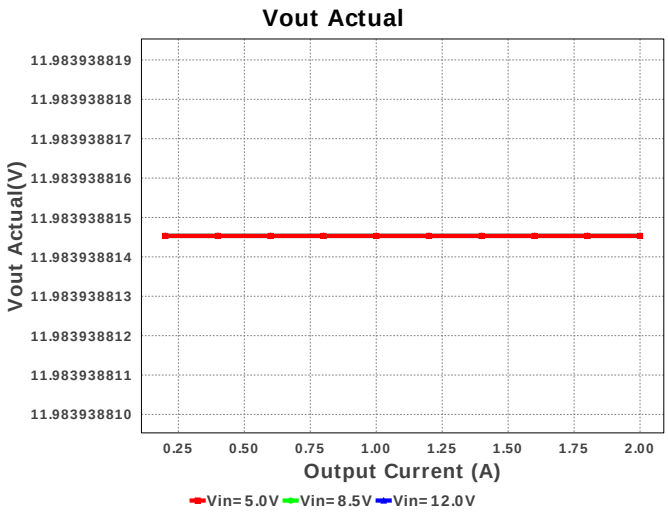


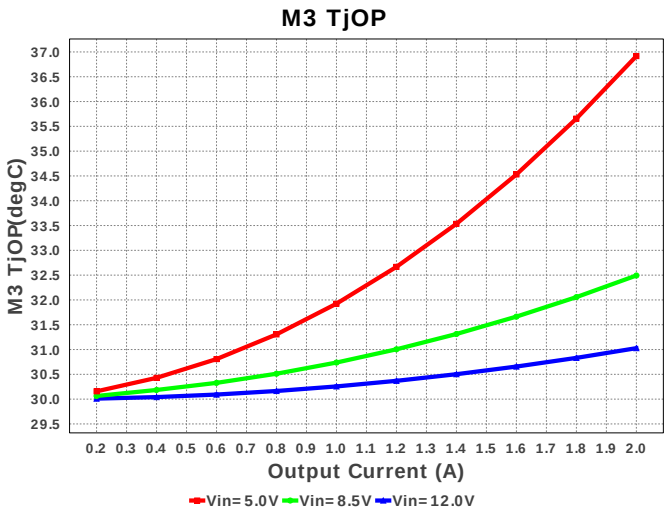


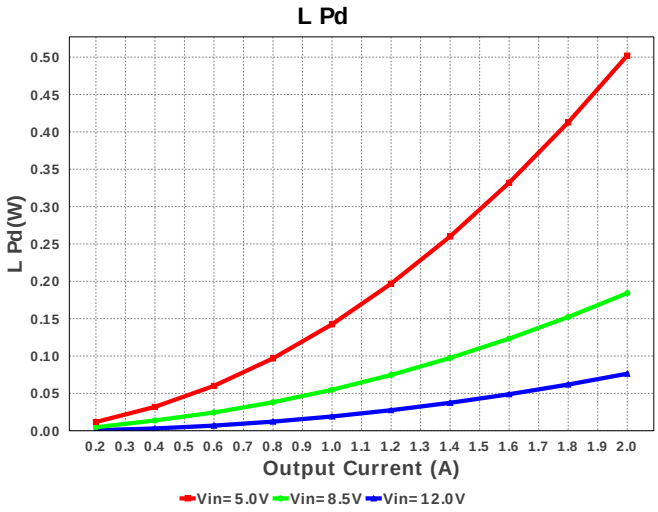


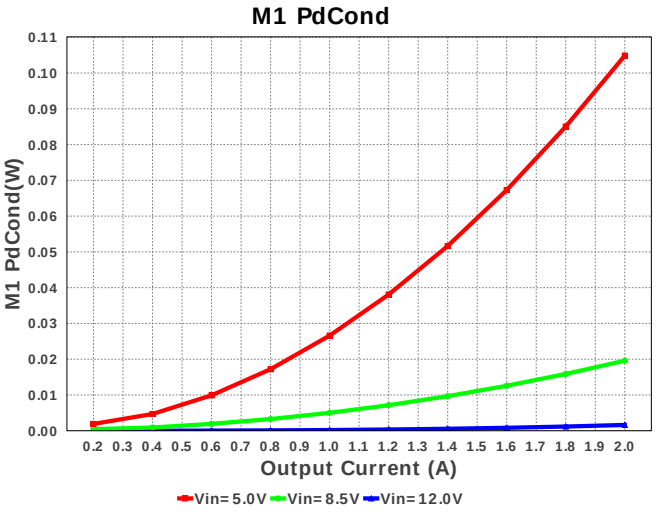


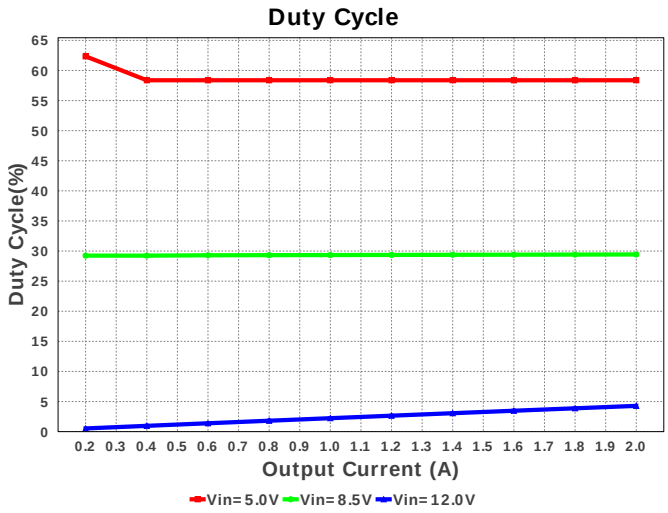


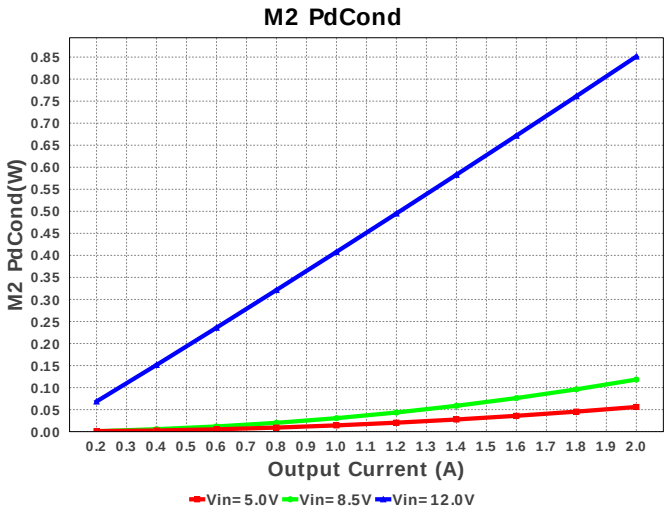


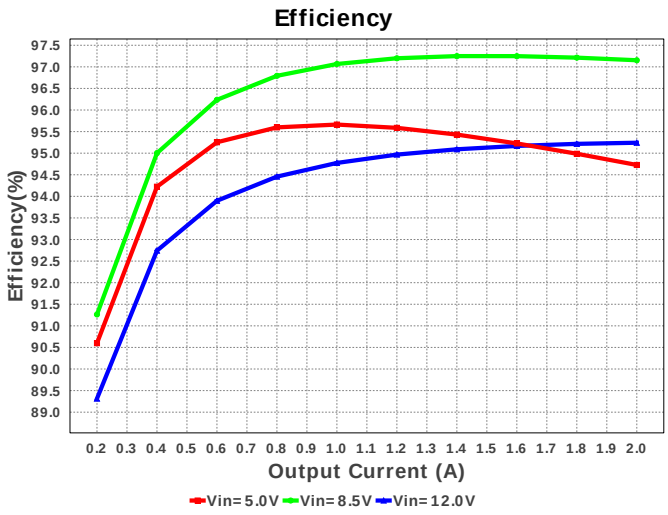


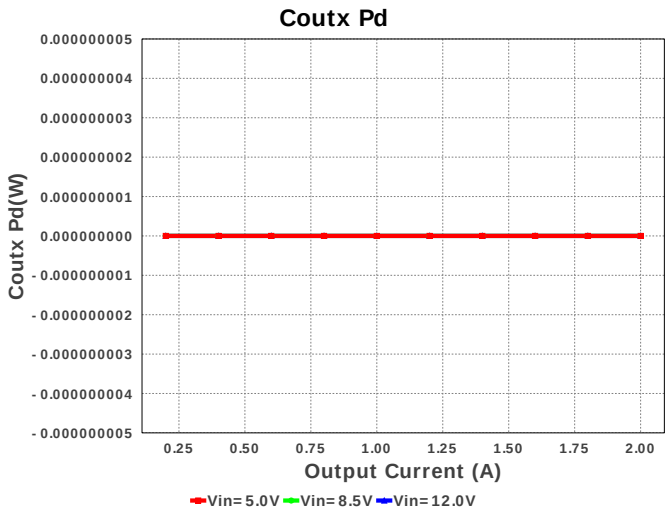


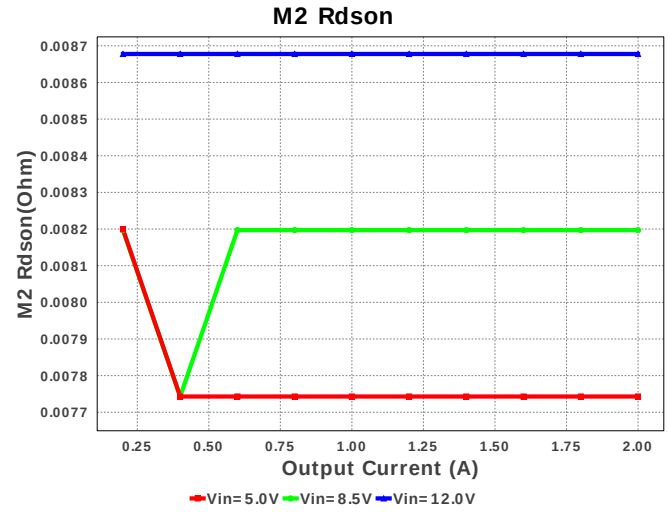


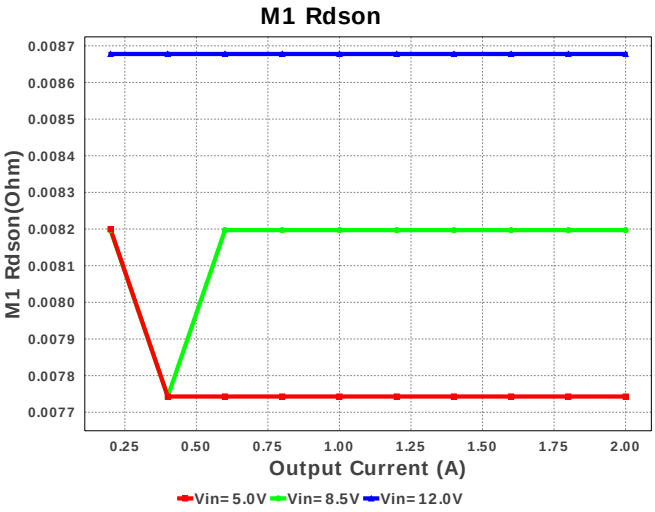


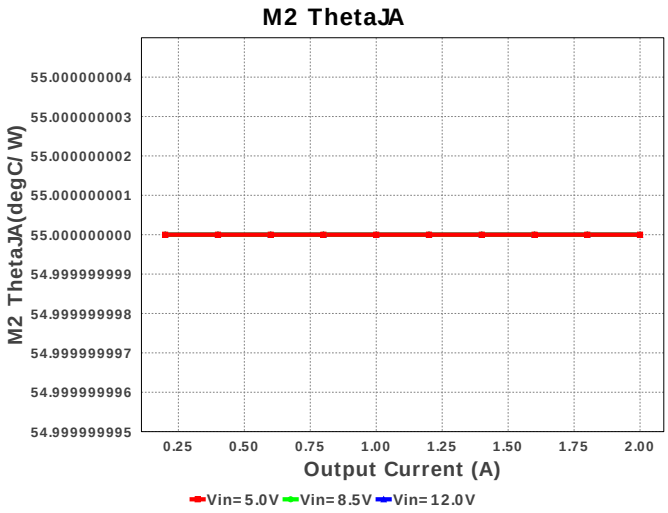


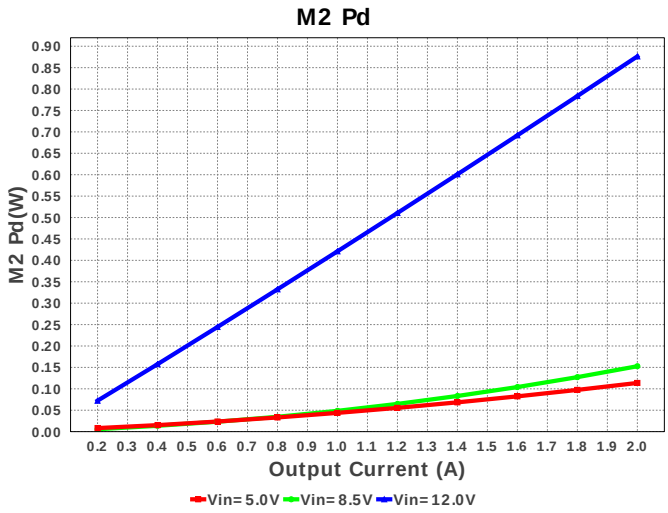


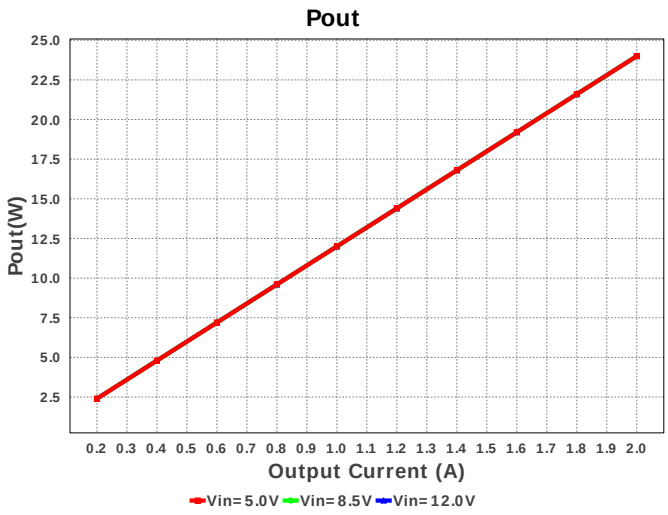


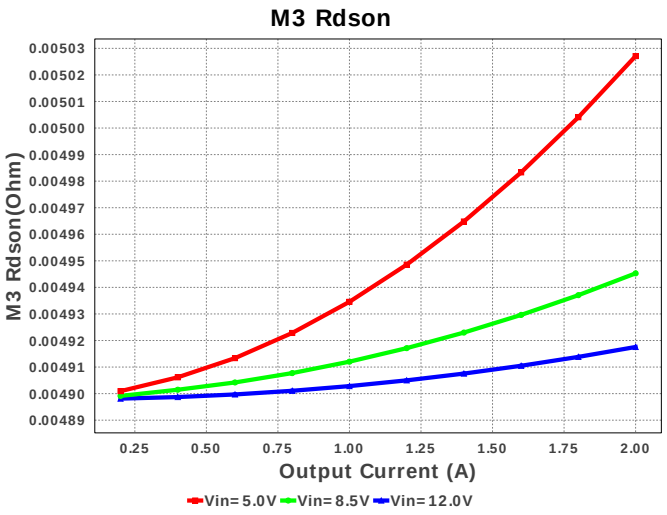


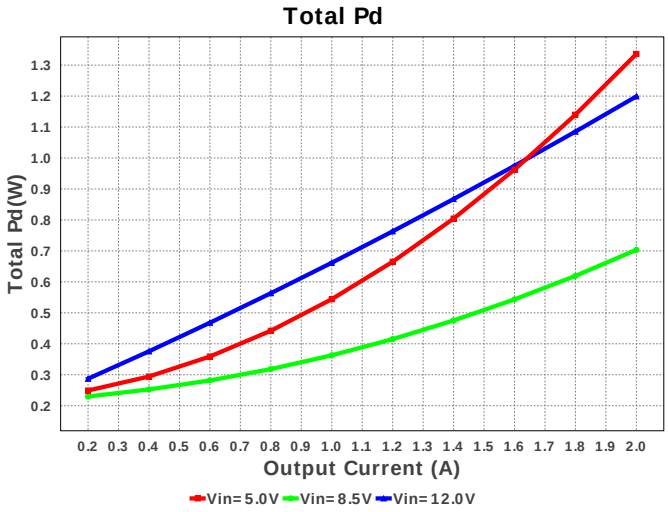


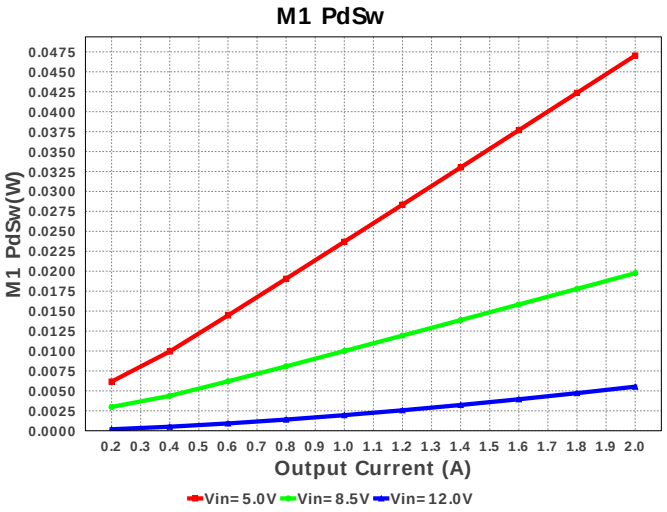


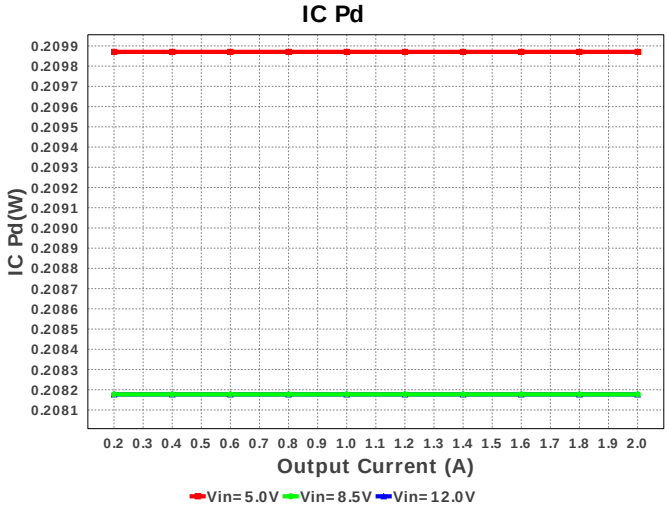


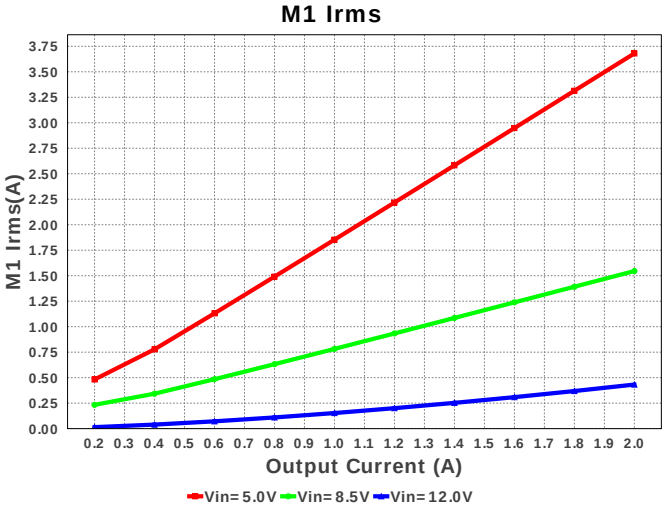


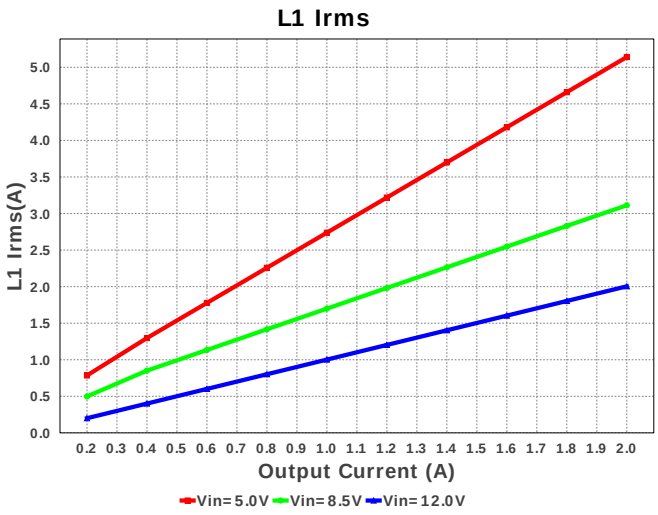


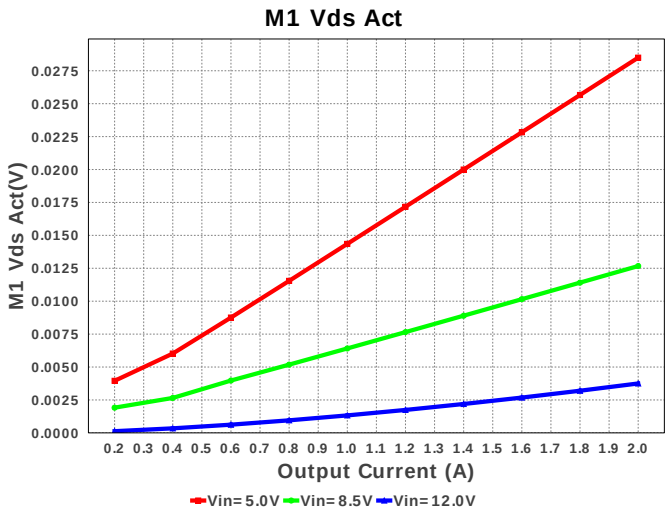


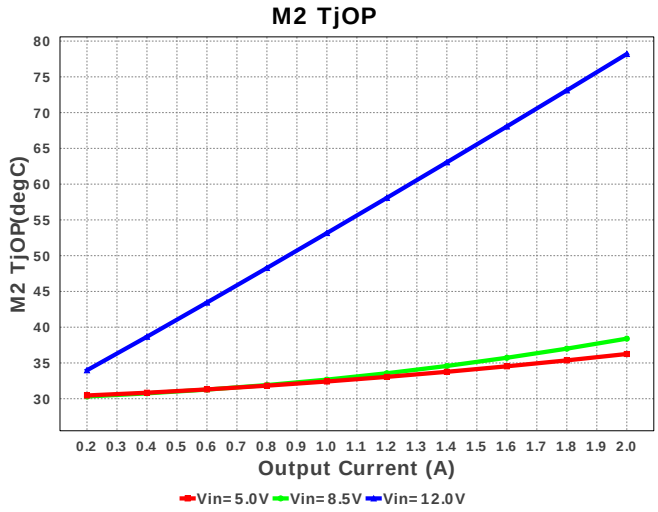


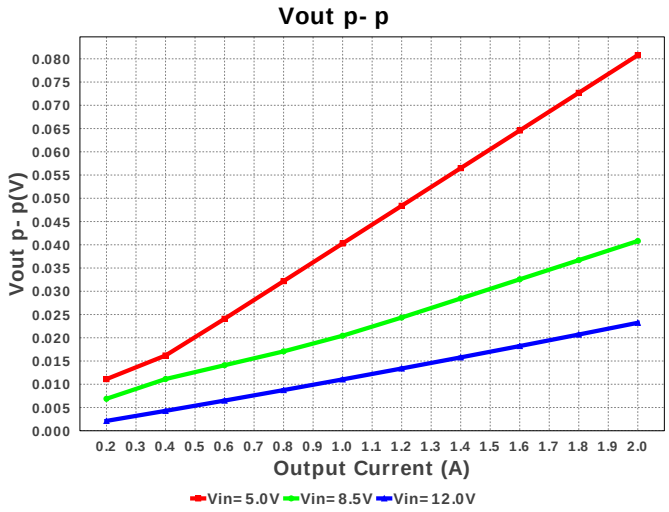


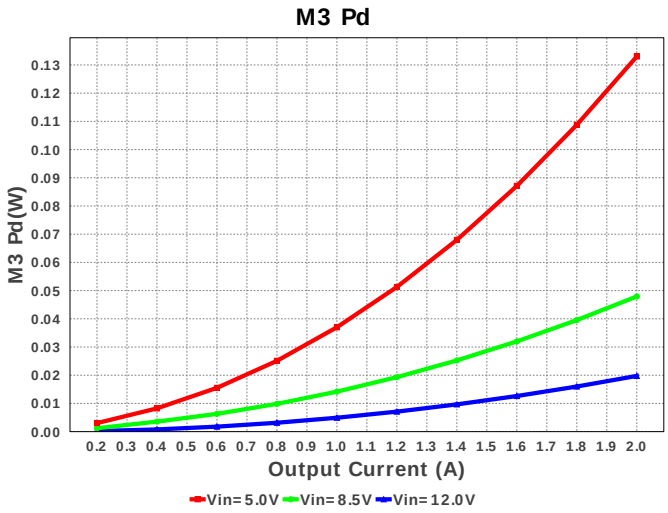


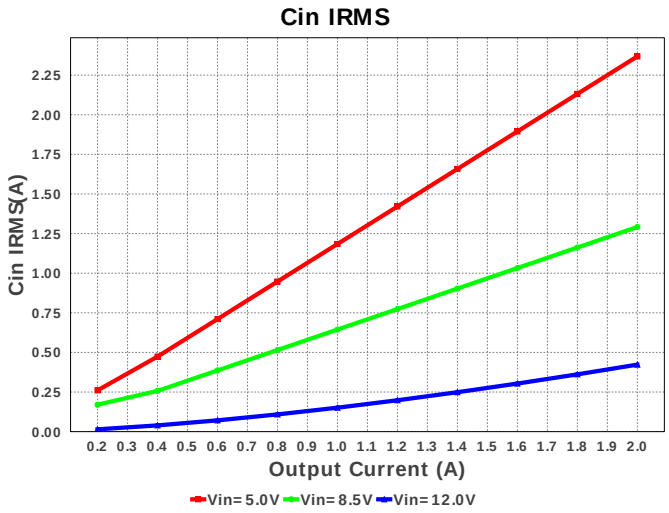












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.379 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	2.031 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	335.824 mA	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	5.131 A	Current	Average input current
5.	L Ipp	1.174 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	5.139 A	Current	Inductor ripple current
7.	M1 Irms	3.705 A	Current	MOSFET RMS ripple current
8.	M2 Irms	2.619 A	Current	MOSFET RMS ripple current
9.	SW Ipk	5.416 A	Current	Peak switch current
10.	BOM Count	27	General	Total Design BOM count
11.	FootPrint	1.972 k mm^2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Frequency	53.254 kHz	General	Switching frequency
13.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
14.	M1 Rdson	8.204 mOhm	General	Drain-Source On-resistance
15.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	M2 Rdson	8.204 mOhm	General	Drain-Source On-resistance
17.	M2 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
18.	M2 Vds Act	21.491 mV	General	M Vds
19.	Mode	CCM	General	Conduction Mode
20.	Pout	24.0 W	General	Total output power
21.	Total BOM	$0.0	General	Total BOM Cost
22.	M3 TjOP	39.06 degC	Op_Point	M3 MOSFET junction temperature
23.	Vout Actual	11.984 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
24.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
25.	Duty Cycle	58.583 %	Op_point	Duty cycle
26.	Efficiency	93.547 %	Op_point	Steady state efficiency
27.	IC Tj	38.544 degC	Op_point	IC junction temperature
28.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
29.	IOUT_OP	2.0 A	Op_point	Iout operating point
30.	M1 TjOP	38.799 degC	Op_point	M1 MOSFET junction temperature
31.	M2 TjOP	36.425 degC	Op_point	MOSFET junction temperature
32.	VIN_OP	5.0 V	Op_point	Vin operating point
33.	Vout p-p	79.884 mV	Op_point	Peak-to-peak output ripple voltage
34.	Cin Pd	169.736 mW	Power	Input capacitor power dissipation
35.	Cout Pd	49.823 mW	Power	Output capacitor power dissipation
36.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
37.	IC Pd	213.596 mW	Power	IC power dissipation
38.	L Pd	501.73 mW	Power	Inductor power dissipation
39.	M1 Pd	159.986 mW	Power	MOSFET power dissipation
40.	M1 Pd	159.986 mW	Power	MOSFET power dissipation
41.	M1 PdCond	112.63 mW	Power	M1 MOSFET conduction losses
42.	M1 PdSw	47.355 mW	Power	M1 MOSFET switching losses
43.	M2 Pd	116.816 mW	Power	MOSFET power dissipation
44.	M2 PdCond	59.11 mW	Power	M2 MOSFET conduction losses
45.	M2 PdQrr	1.47 mW	Power	Synchronous Boost High Side Reverse Recovery
46.	M2 Pdbody	56.237 mW	Power	Power dissipation through lower FET
47.	M3 Pd	174.231 mW	Power	M3 MOSFET total power dissipation
48.	M3 Rdson	6.585 mOhm	Power	Drain-Source On-resistance
49.	Total Pd	1.656 W	Power	Total Power Dissipation
50.	M1 Vds Act	30.398 mV		M Vds
51.	M3 ThetaJA	52.0 degC/W		MOSFET junction-to-ambient thermal resistance
52.	Vout Tolerance	3.345 %		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	12.0	Maximum input voltage
3.	VinMin	5.0	Minimum input voltage
4.	Vout	12.0	Output Voltage
5.	base_pn	LM5121	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. The LM5121 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. LM5121 Product Folder : http://www.ti.com/product/LM5121 : contains the data sheet and other resources.