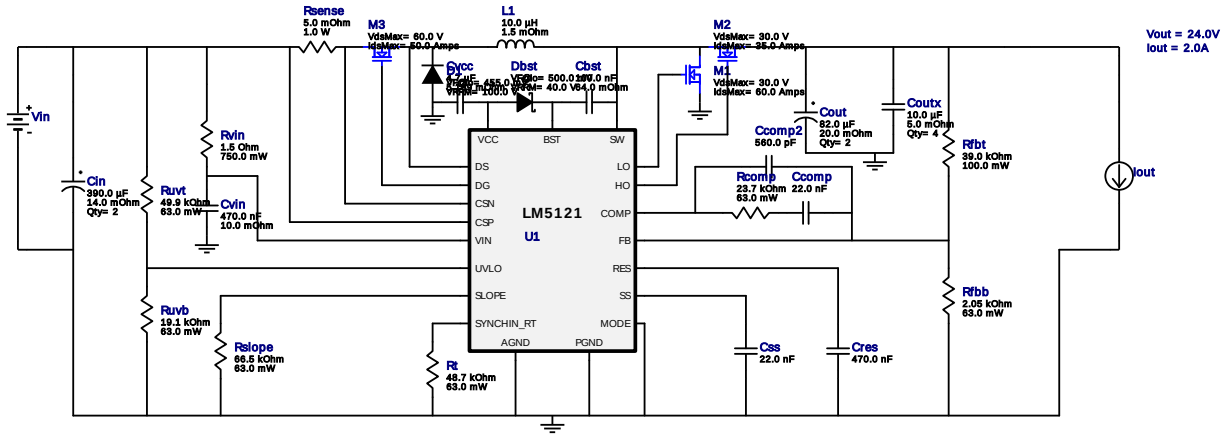
WEBENCH® Design Report

VinMin = 5.0V
VinMax = 12.0V
Vout = 24.0V
Iout = 2.0A

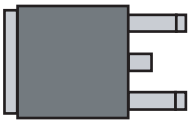
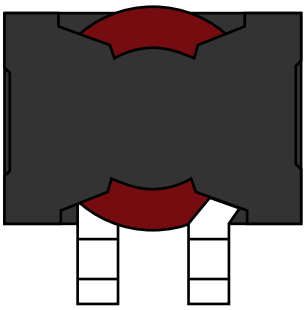
Device = LM5121MH/NOPB
Topology = Boost
Created = 8/11/16 8:02:13 AM
BOM Cost = $0.00
BOM Count = 31
Total Pd = 3.58W

Design : 4085315/15 LM5121MH/NOPB
LM5121MH/NOPB 5.0V-12.0V to 24.00V @ 2.0A

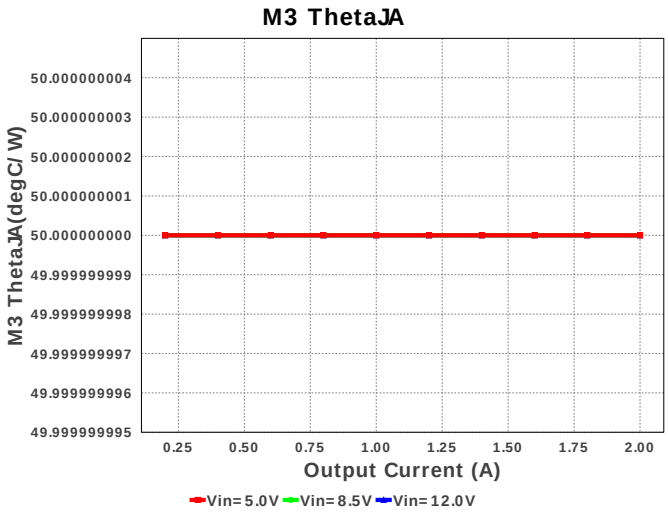


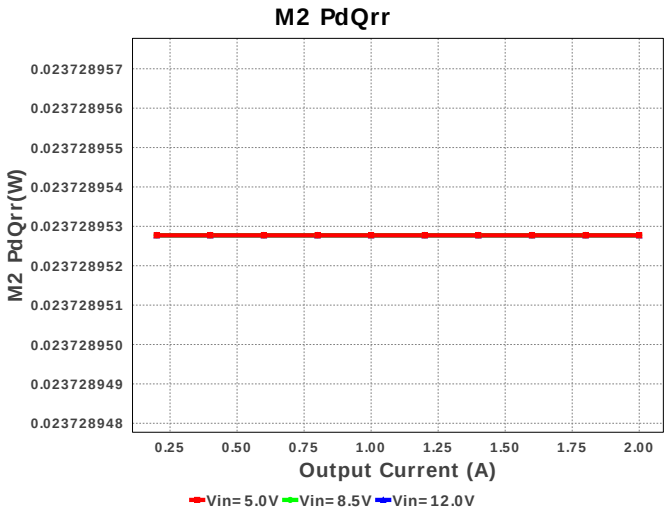
Electrical BOM

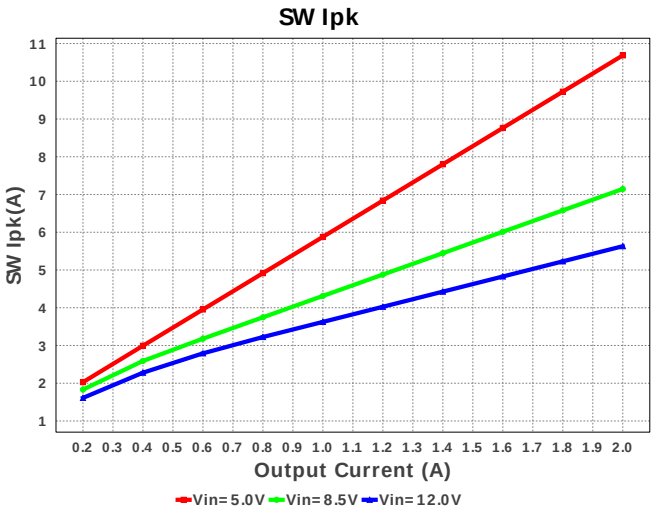
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
2.	Ccomp	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB561 Series= X7R	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	Panasonic	20SVPF390M Series= ?	Cap= 390.0 uF ESR= 14.0 mOhm VDC= 20.0 V IRMS= 4.95 A	2	$0.63	CAPSMT_62_E12 106 mm²
5.	Cout	Panasonic	35SVPF82M Series= ?	Cap= 82.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 4.0 A	2	$0.61	CAPSMT_62_E12 106 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	GRM155R71E223KA61D Series= X7R	Cap= 22.0 nF VDC= 25.0 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

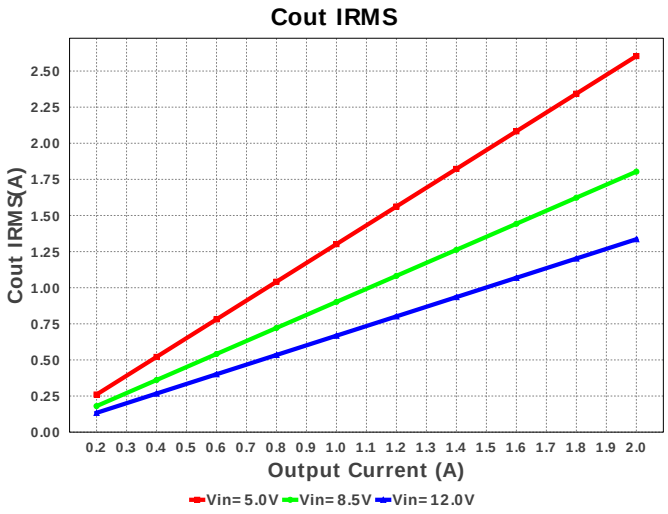
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cvin	MuRata	GRM188R71C474KA88D Series= X7R	Cap= 470.0 nF ESR= 10.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0603 5 mm^2
11.	D1	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.33	 DDPAK 210 mm^2
12.	Dbst	Vishay-Semiconductor	SS14-E3/61T	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.08	 SMA 37 mm^2
13.	L1	Coilcraft	SER2915L-103KL	L= 10.0 µH DCR= 1.5 mOhm	1	$1.88	 SER2915L 652 mm^2
14.	M1	Texas Instruments	CSD17309Q3	VdsMax= 30.0 V IdsMax= 60.0 Amps	1	$0.42	 TRANS_NexFET_Q3 18 mm^2
15.	M2	Texas Instruments	CSD17577Q3A	VdsMax= 30.0 V IdsMax= 35.0 Amps	1	$0.24	 TRANS_NexFET_Q3A 18 mm^2
16.	M3	Infineon Technologies	BSC076N06NS3G	VdsMax= 60.0 V IdsMax= 50.0 Amps	1	$0.34	 PG-TDSON-8 55 mm^2
17.	Rcomp	Vishay-Dale	CRCW040223K7FKED Series= CRCW..e3	Res= 23.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Rfbb	Vishay-Dale	CRCW04022K05FKED Series= CRCW..e3	Res= 2.05 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
19.	Rfbt	Yageo America	RC0603FR-0739KL Series= ?	Res= 39.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
20.	Rsense	Susumu Co Ltd	PRL1632-R005-F-T1 Series= PRL1632	Res= 5.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	 0612 11 mm^2
21.	Rslope	Vishay-Dale	CRCW040266K5FKED Series= CRCW..e3	Res= 66.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
22.	Rt	Vishay-Dale	CRCW040248K7FKED Series= CRCW..e3	Res= 48.7 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	Stackpole Electronics Inc	RMCF2010FT1R50 Series= ?	Res= 1.5 Ohm Power= 750.0 mW Tolerance= 1.0%	1	$0.03	 2010 32 mm^2

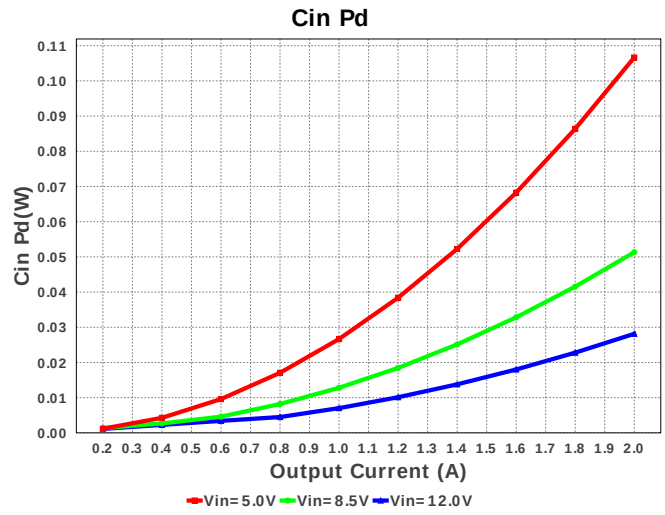
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	U1	Texas Instruments	LM5121MH/NOPB	Switcher	1	$2.46	 MXA20A 71 mm²

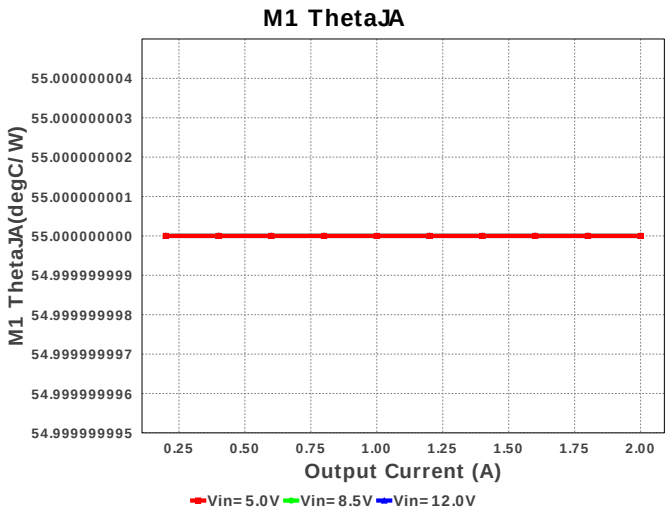


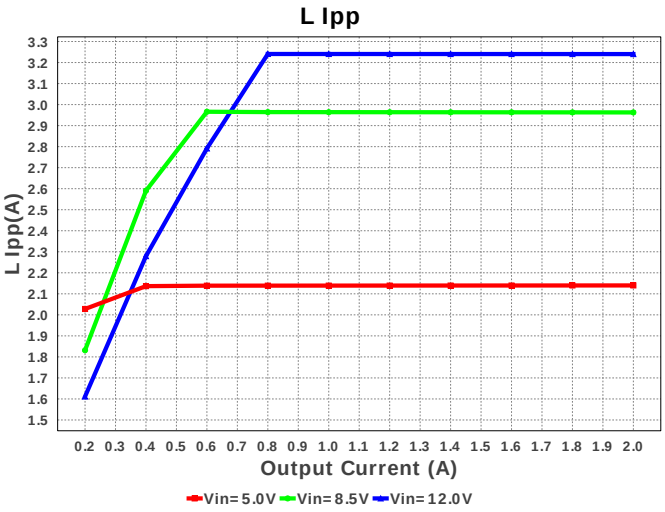


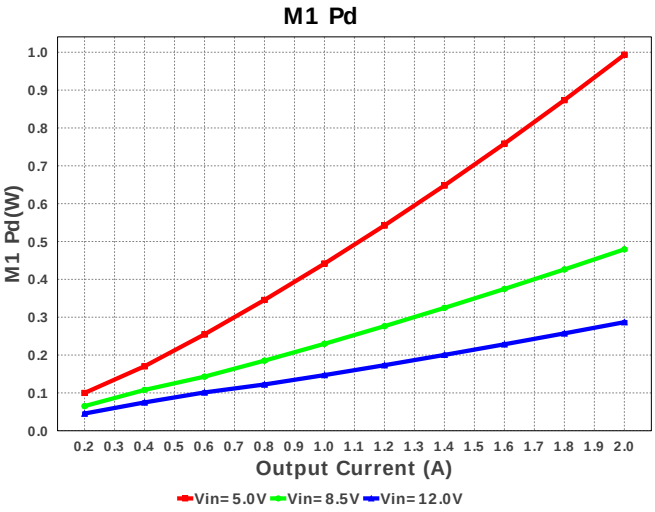


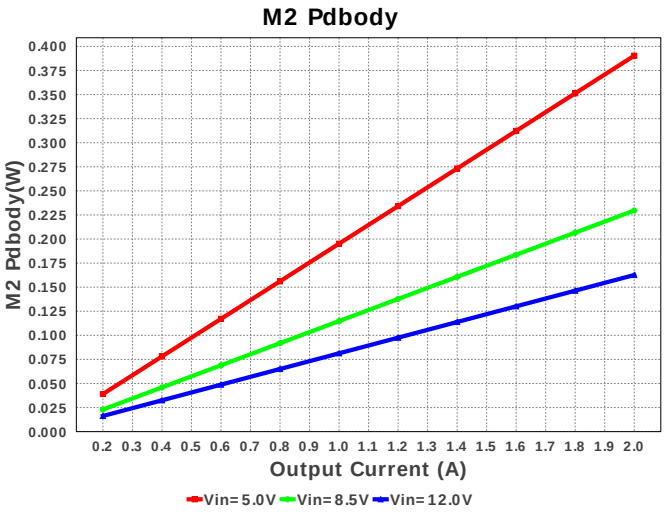


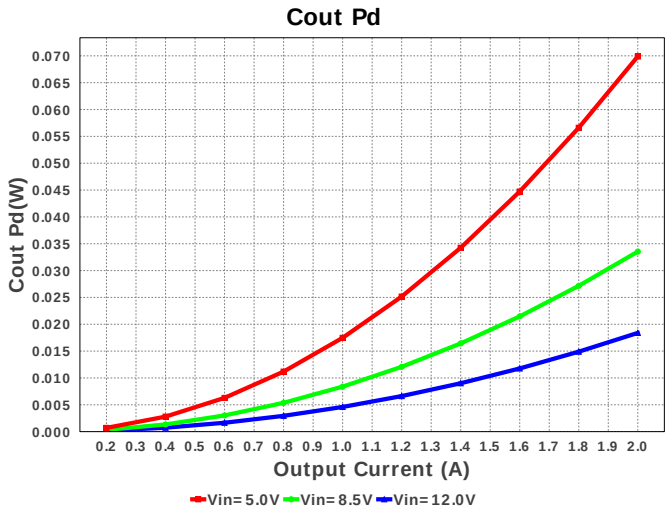


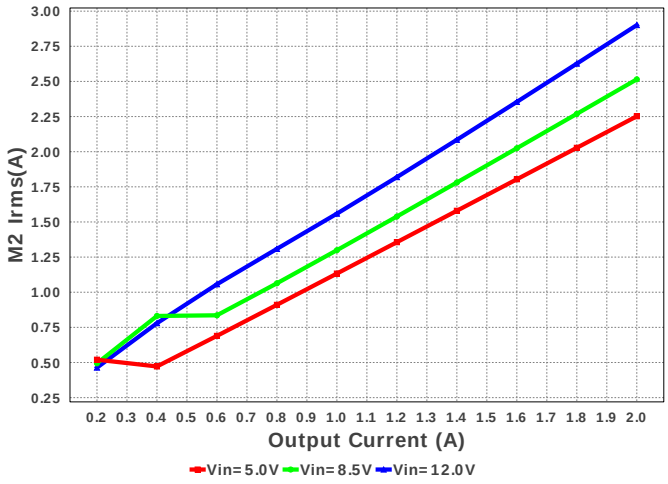


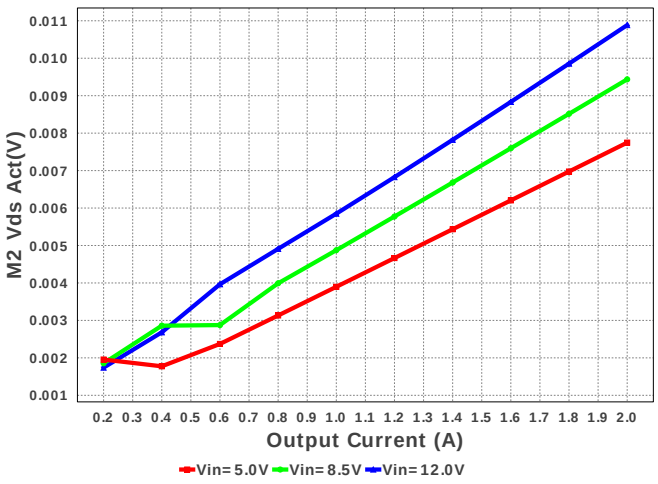


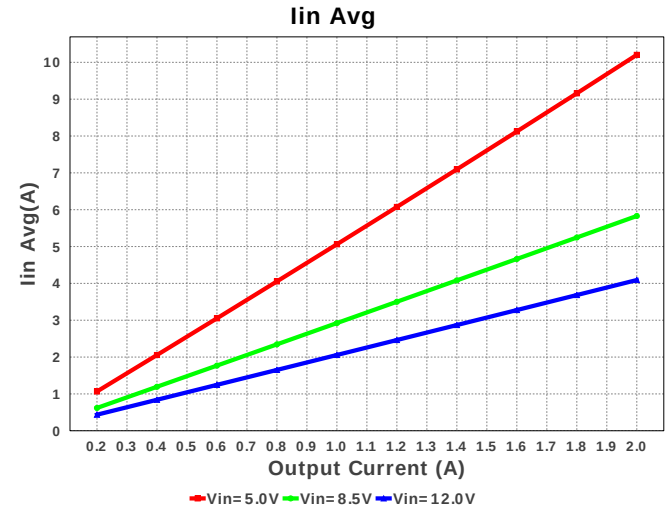


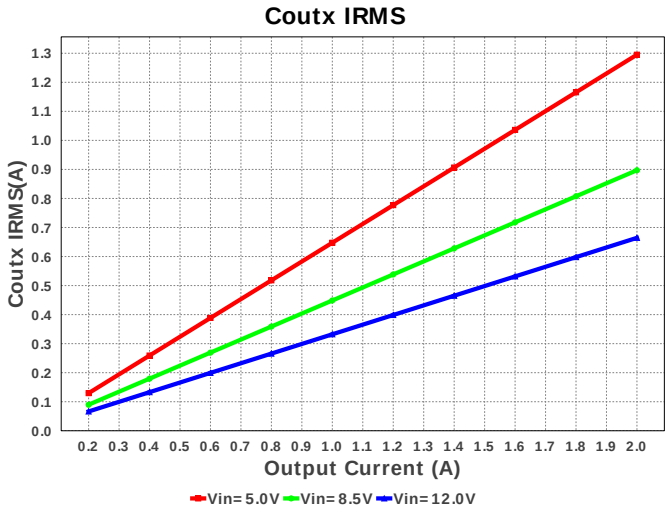


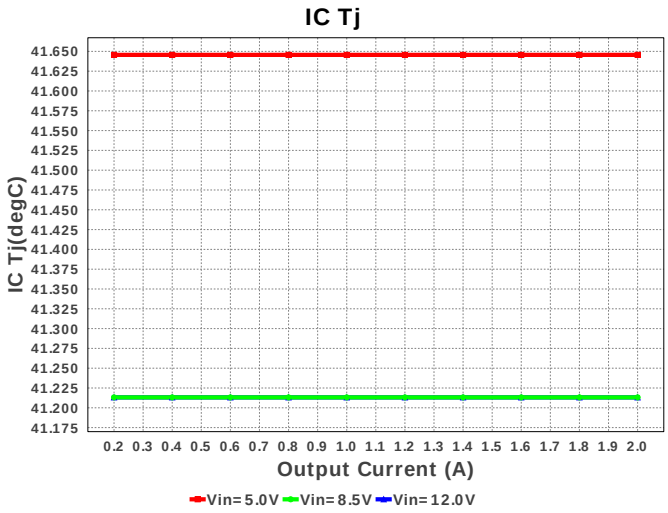


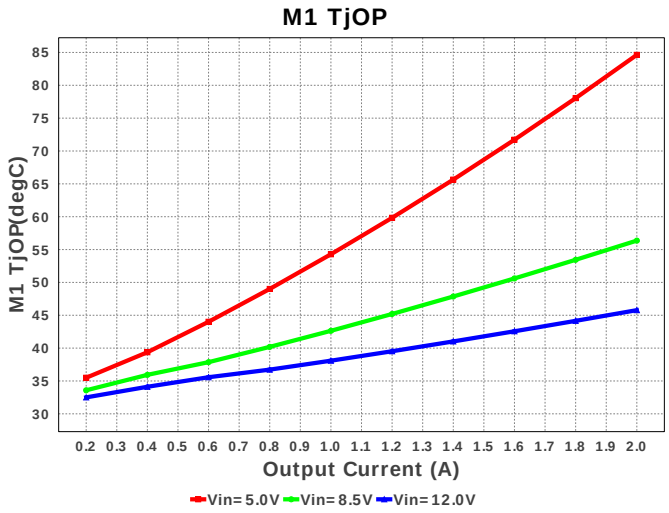


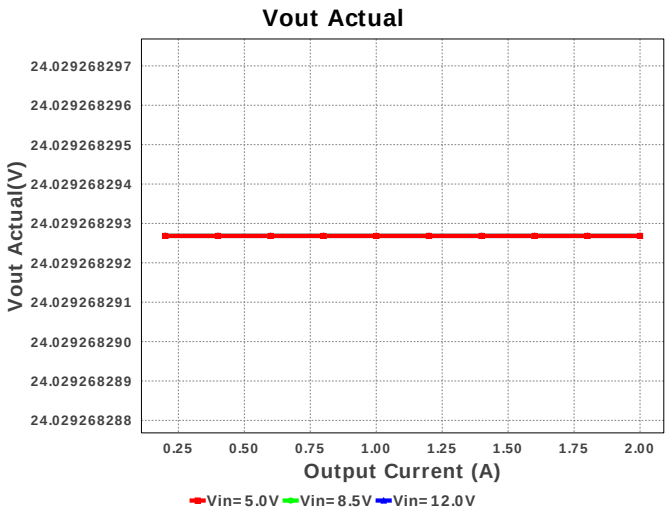


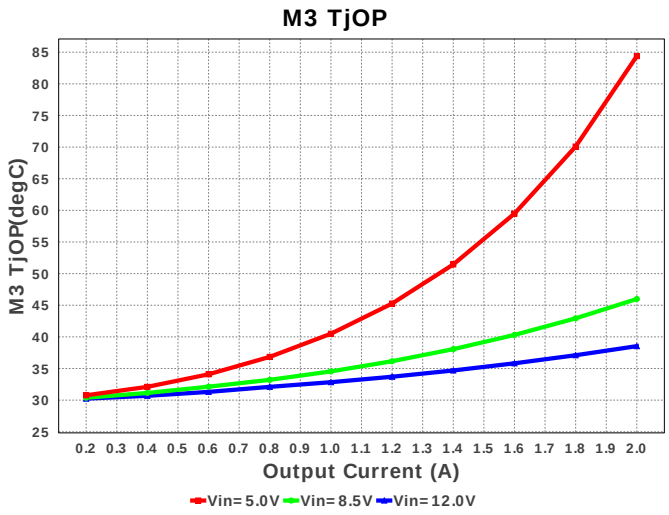


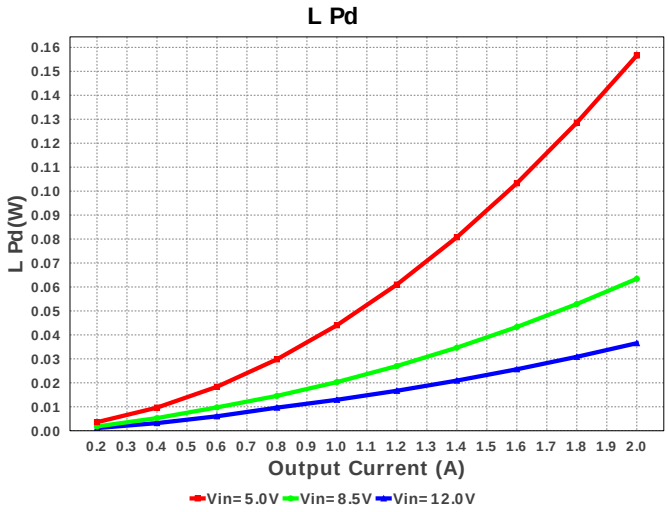


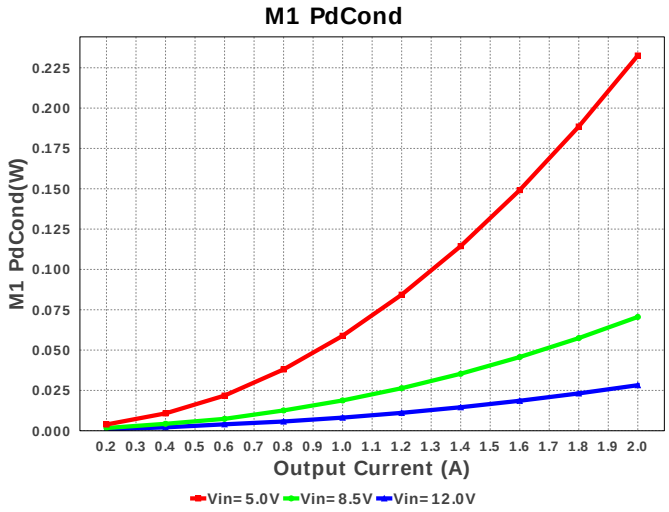


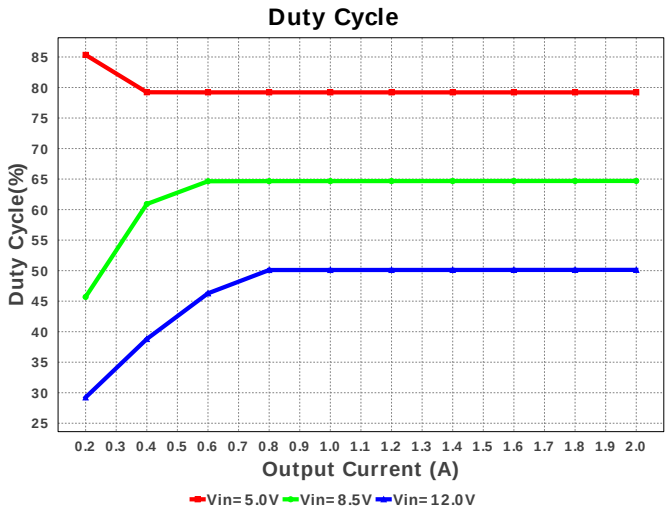


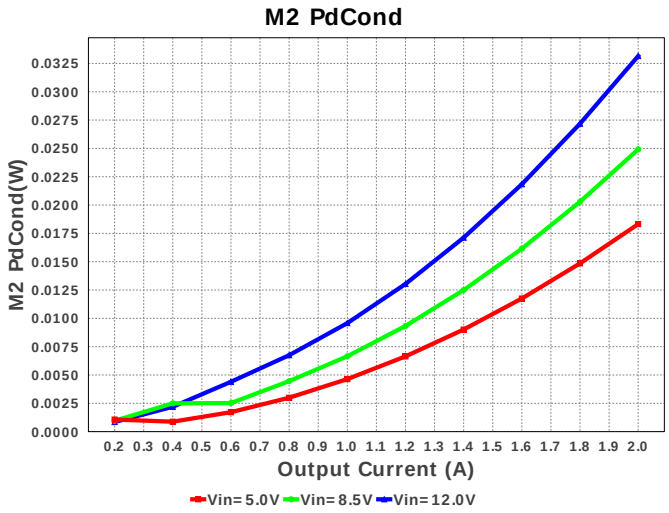


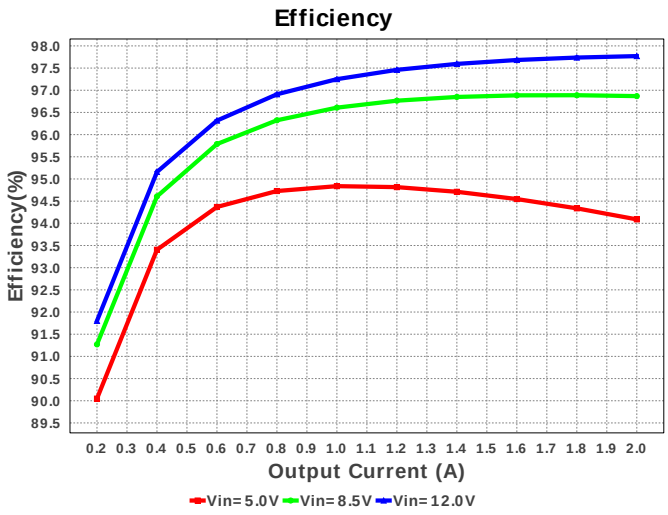


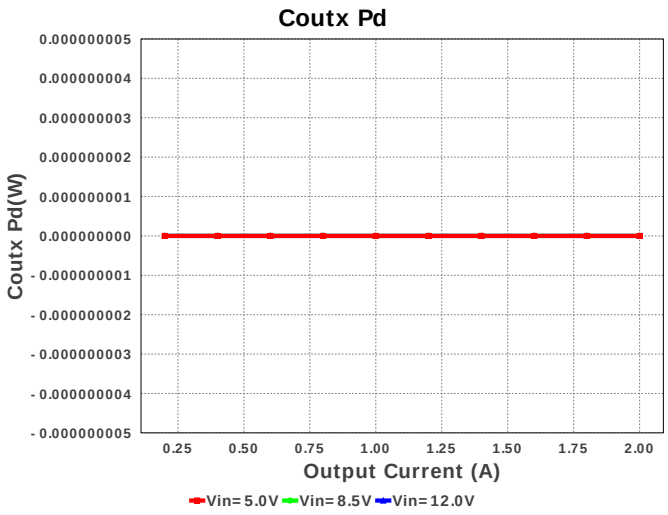


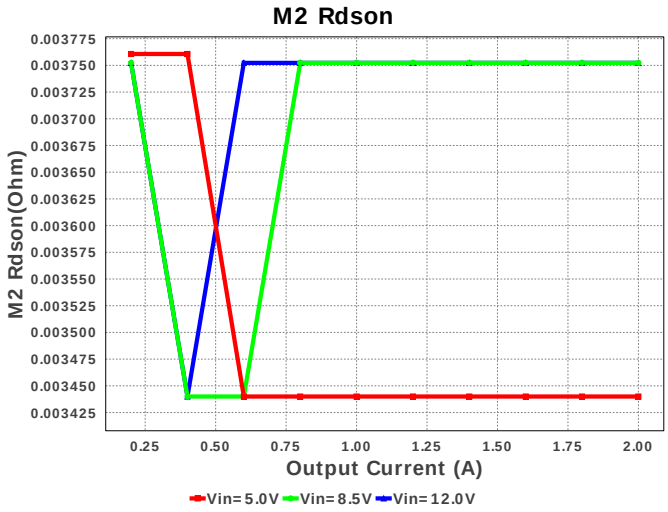


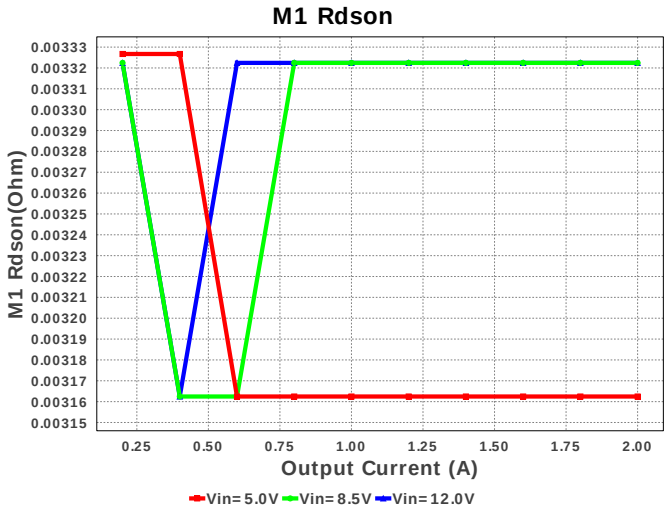


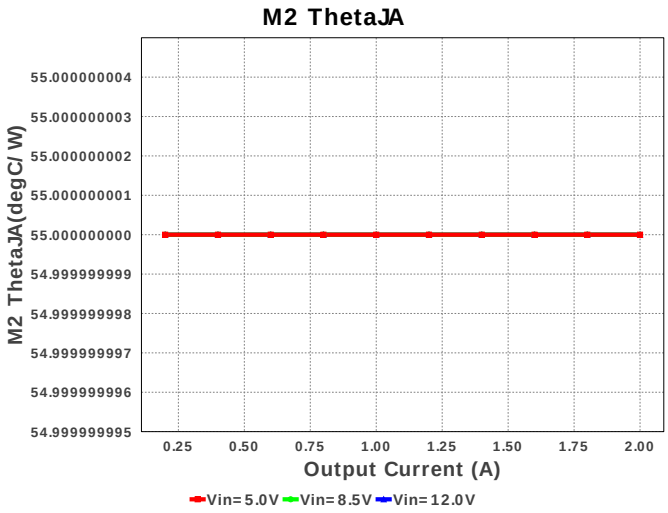


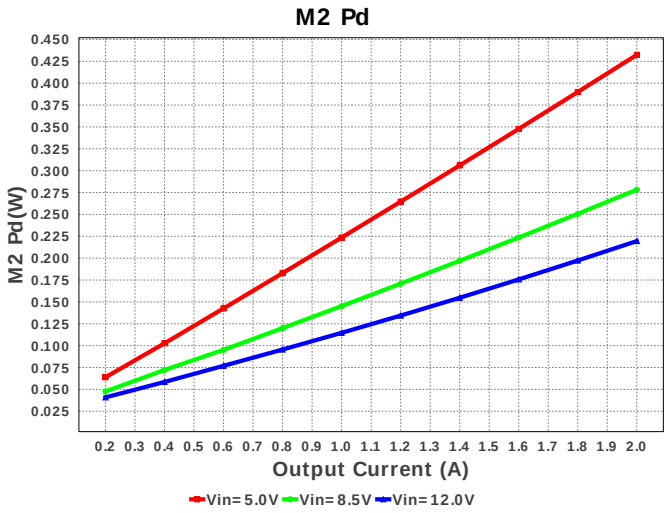


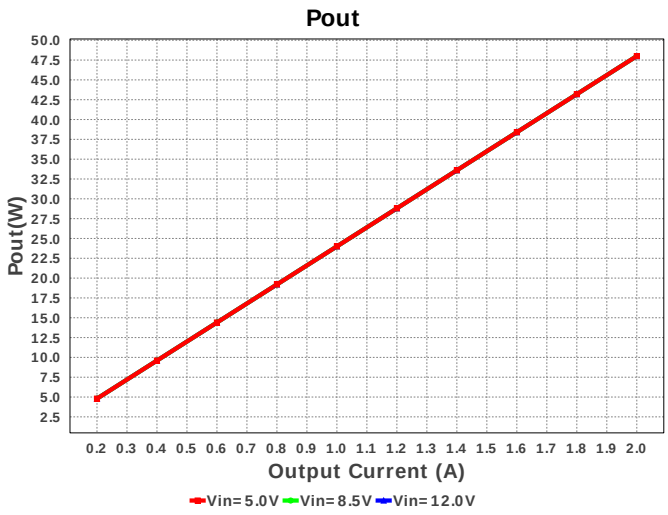


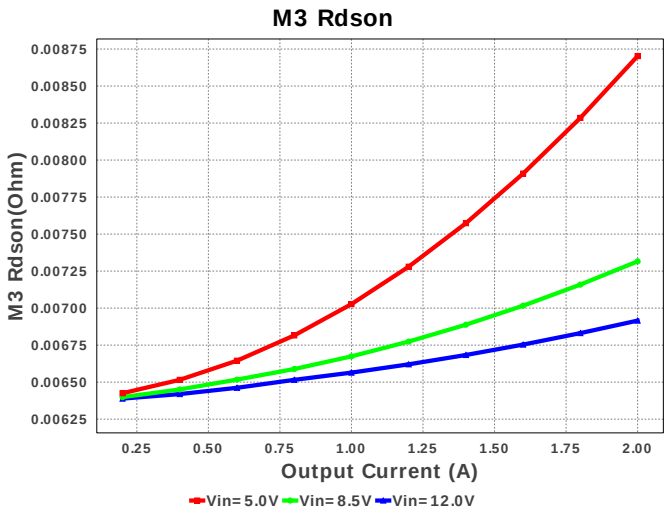


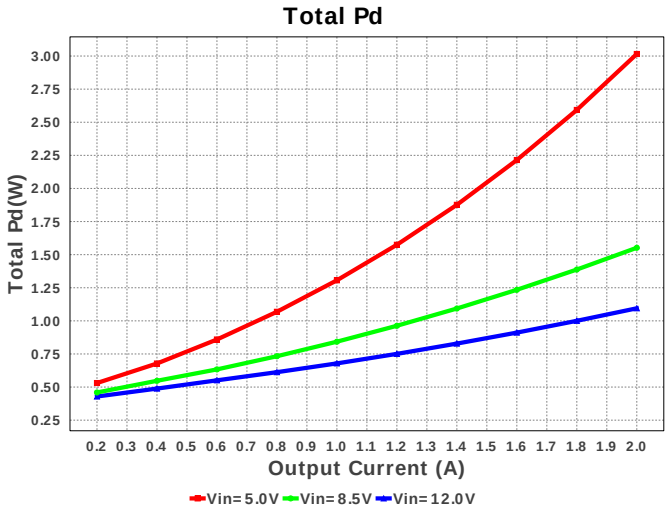


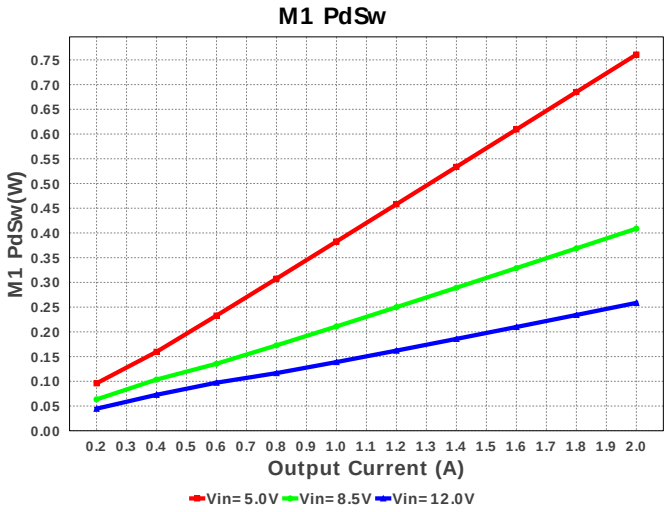


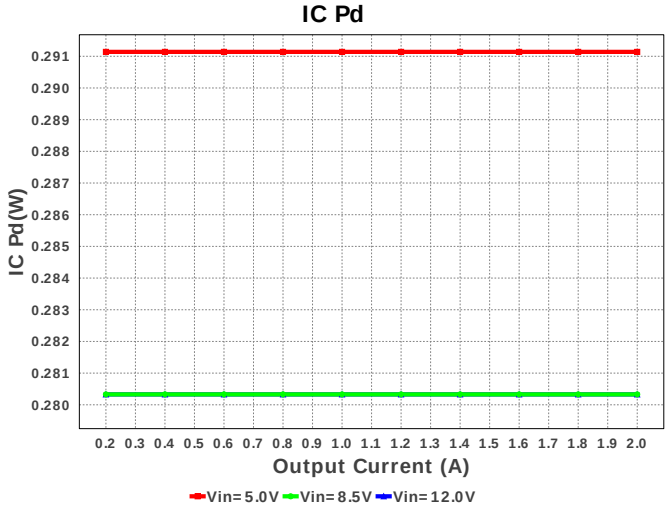


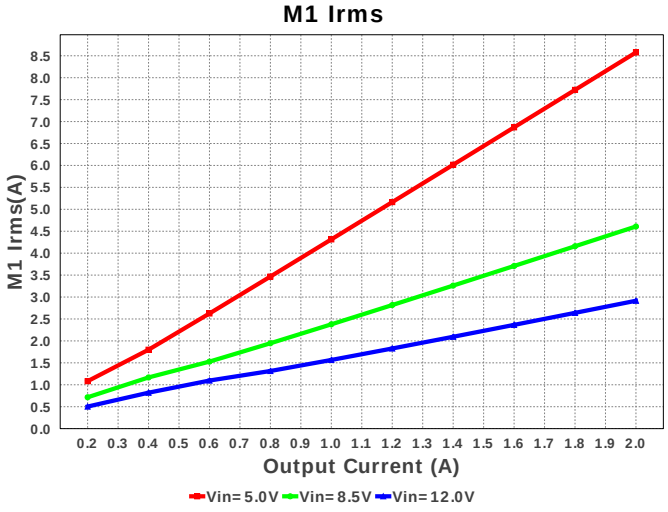


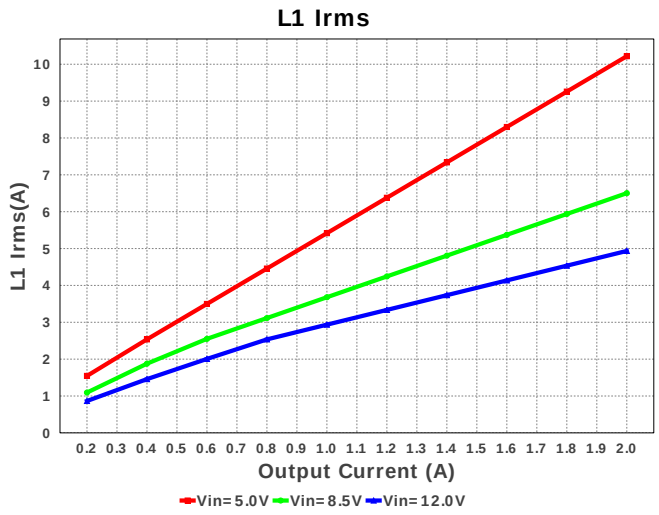


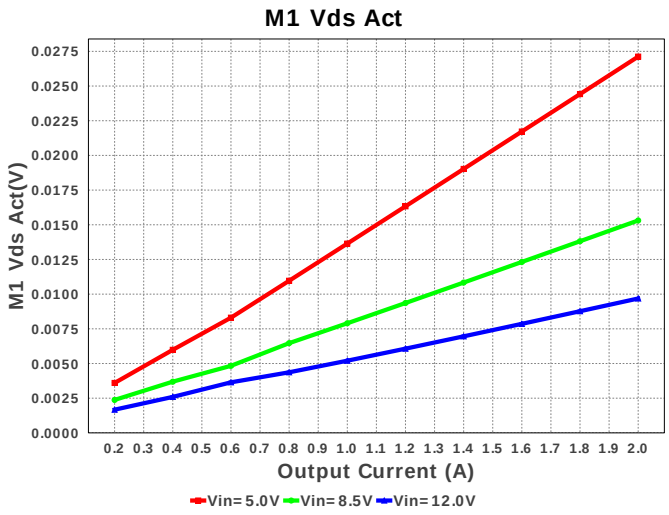


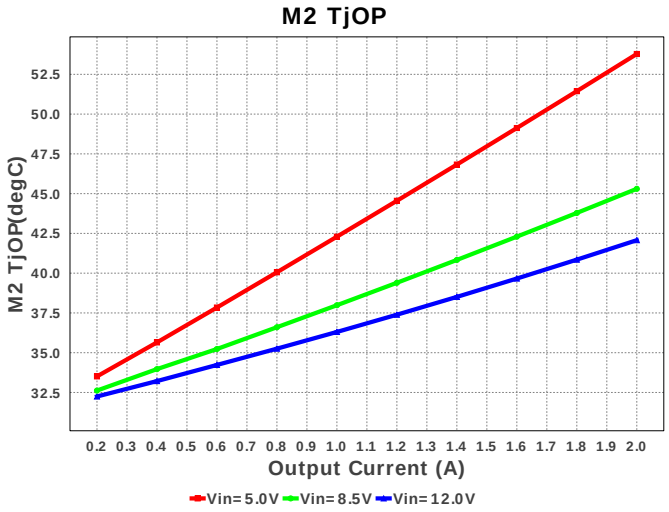


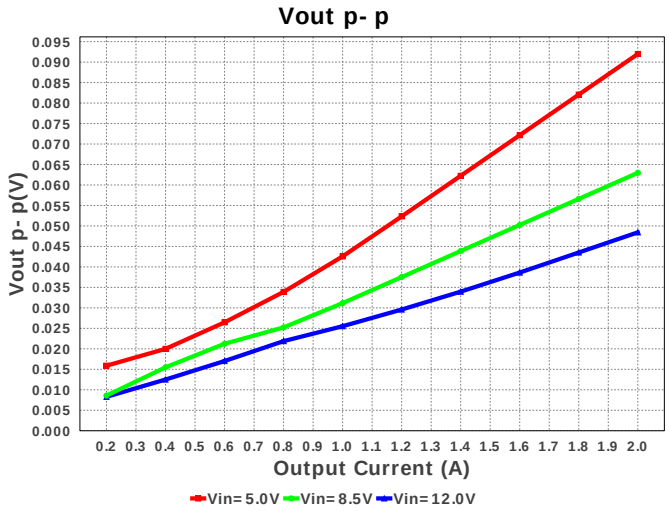


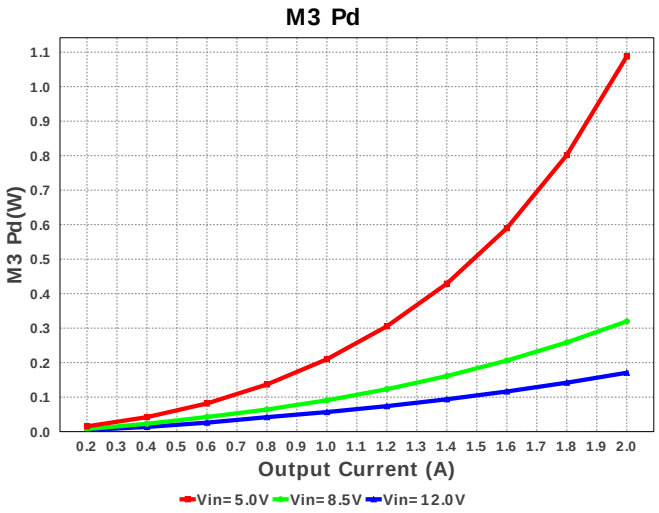


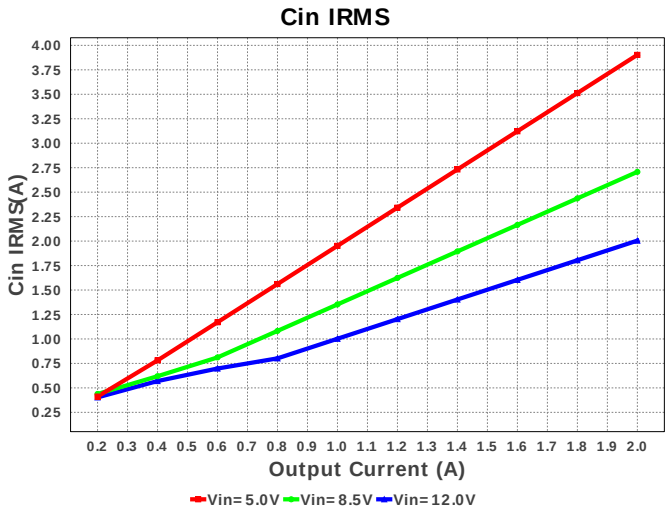












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	3.914 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	2.559 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	1.34 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	10.316 A	Current	Average input current
5.	L Ipp	2.13 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	10.215 A	Current	Inductor ripple current
7.	M1 Irms	8.62 A	Current	MOSFET RMS ripple current
8.	M2 Irms	2.25 A	Current	MOSFET RMS ripple current
9.	SW Ipk	10.726 A	Current	Peak switch current
10.	BOM Count	31	General	Total Design BOM count
11.	FootPrint	1.809 k mm^2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Frequency	184.805 kHz	General	Switching frequency
13.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
14.	M1 Rdson	3.336 mOhm	General	Drain-Source On-resistance
15.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	M2 Rdson	3.779 mOhm	General	Drain-Source On-resistance
17.	M2 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
18.	M2 Vds Act	8.505 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.	M3 TjOP	84.334 degC	Op_Point	M3 MOSFET junction temperature
23.	Vout Actual	24.029 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
24.	Vout OP	24.0 V	Op_Point	Operational Output Voltage
25.	Duty Cycle	79.298 %	Op_point	Duty cycle
26.	Efficiency	93.06 %	Op_point	Steady state efficiency
27.	IC Tj	42.597 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	85.693 degC	Op_point	M1 MOSFET junction temperature
31.	M2 TjOP	53.877 degC	Op_point	MOSFET junction temperature
32.	VIN_OP	5.0 V	Op_point	Vin operating point
33.	Vout p-p	90.756 mV	Op_point	Peak-to-peak output ripple voltage
34.	Cin Pd	107.253 mW	Power	Input capacitor power dissipation
35.	Cout Pd	67.713 mW	Power	Output capacitor power dissipation
36.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
37.	IC Pd	314.924 mW	Power	IC power dissipation
38.	L Pd	156.516 mW	Power	Inductor power dissipation
39.	M1 Pd	1.013 W	Power	MOSFET power dissipation
40.	M1 Pd	1.013 W	Power	MOSFET power dissipation
41.	M1 PdCond	247.909 mW	Power	M1 MOSFET conduction losses
42.	M1 PdSw	764.684 mW	Power	M1 MOSFET switching losses
43.	M2 Pd	434.133 mW	Power	MOSFET power dissipation
44.	M2 PdCond	20.096 mW	Power	M2 MOSFET conduction losses
45.	M2 PdQrr	23.729 mW	Power	Synchronous Boost High Side Reverse Recovery
46.	M2 Pdbody	390.308 mW	Power	Power dissipation through lower FET
47.	M3 Pd	1.087 W	Power	M3 MOSFET total power dissipation
48.	M3 Rdson	8.701 mOhm	Power	Drain-Source On-resistance
49.	Total Pd	3.58 W	Power	Total Power Dissipation
50.	M1 Vds Act	28.758 mV		M Vds
51.	M3 ThetaJA	50.0 degC/W		MOSFET junction-to-ambient thermal resistance
52.	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	12.0	Maximum input voltage
3.	VinMin	5.0	Minimum input voltage
4.	Vout	24.0	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.