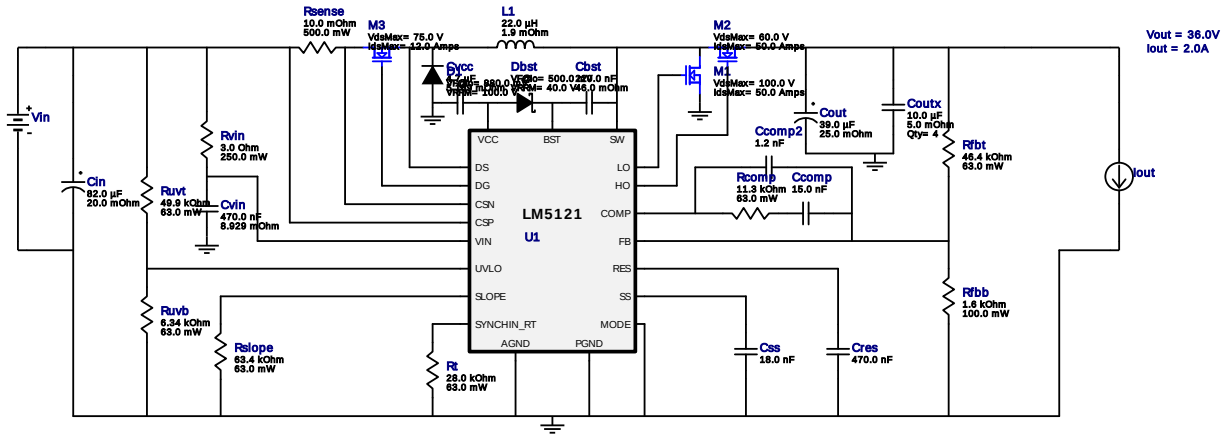
WEBENCH® Design Report

VinMin = 14.0V
VinMax = 22.0V
Vout = 36.0V
Iout = 2.0A

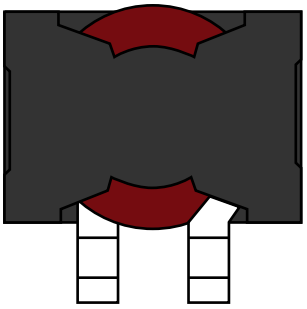
Device = LM5121MH/NOPB
Topology = Boost
Created = 9/23/16 8:27:51 PM
BOM Cost = $0.00
BOM Count = 29
Total Pd = 4.15W

Design : 4802695/3 LM5121MH/NOPB
LM5121MH/NOPB 14.0V-22.0V to 36.00V @ 2.0A

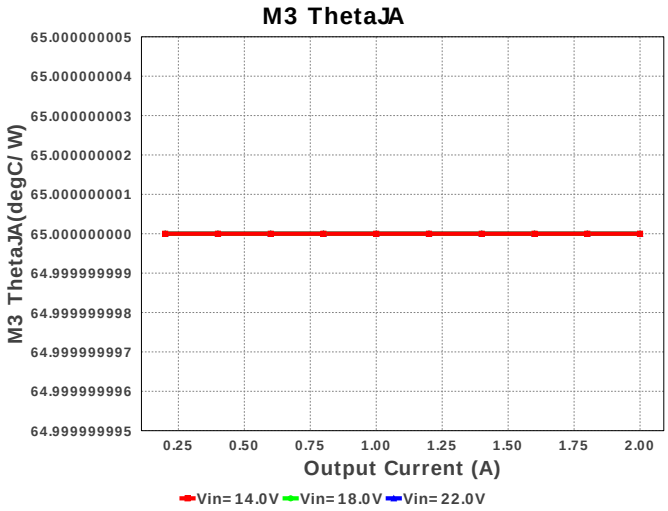


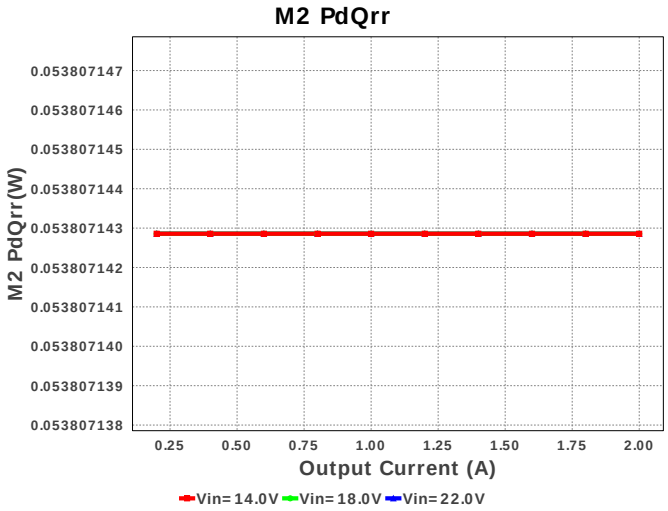
Electrical BOM

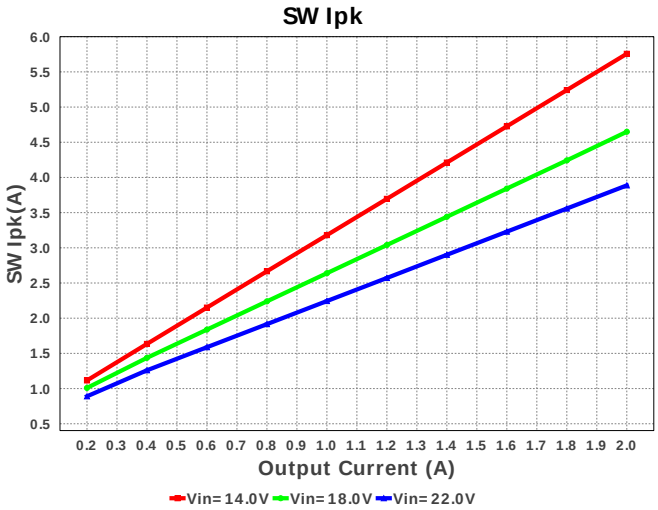
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	Kemet	C0805C224K5RACTU Series= X7R	Cap= 220.0 nF ESR= 46.0 mOhm VDC= 50.0 V IRMS= 2.65 A	1	$0.02	0805 7 mm²
2.	Ccomp	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Samsung Electro-Mechanics	CL21C122JBFNNWE Series= C0G/NP0	Cap= 1.2 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	Panasonic	35SVPF82M Series= ?	Cap= 82.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 4.0 A	1	$0.61	CAPSMT_62_E12 106 mm²
5.	Cout	Panasonic	50SVPF39M Series= ?	Cap= 39.0 uF ESR= 25.0 mOhm VDC= 50.0 V IRMS= 3.8 A	1	$0.72	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	GRM155R71E183KA61D Series= X7R	Cap= 18.0 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

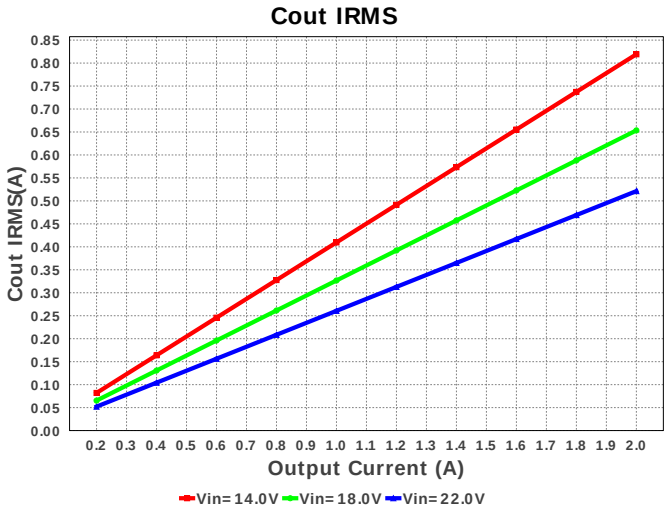
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cvin	TDK	C3216JB2A474K Series= JB	Cap= 470.0 nF ESR= 8.929 mOhm VDC= 100.0 V IRMS= 0.0 A	1	$0.06	 1206 11 mm^2
11.	D1	Vishay-Semiconductor	SS10PH10-M3/86A	VF@Io= 880.0 mV VRRM= 100.0 V	1	$0.29	 TO-277A 56 mm^2
12.	Dbst	Vishay-Semiconductor	SS14-E3/61T	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.08	 SMA 37 mm^2
13.	L1	Coilcraft	SER2915H-223KL	L= 22.0 µH DCR= 1.9 mOhm	1	$1.95	 SER2915H 652 mm^2
14.	M1	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	$0.50	 DQG0008A 18 mm^2
15.	M2	Texas Instruments	CSD18537NQ5A	VdsMax= 60.0 V IdsMax= 50.0 Amps	1	$0.31	 TRANS_NexFET_Q5A 55 mm^2
16.	M3	Vishay-Siliconix	SI7148DP	VdsMax= 75.0 V IdsMax= 12.0 Amps	1	NA	 PowerPAK_SO-8 55 mm^2
17.	Rcomp	Vishay-Dale	CRCW040211K3FKED Series= CRCW..e3	Res= 11.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Rfbb	Yageo America	RC0603FR-071K6L Series= ?	Res= 1.6 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
19.	Rfbt	Vishay-Dale	CRCW040246K4FKED Series= CRCW..e3	Res= 46.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 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	CRCW040263K4FKED Series= CRCW..e3	Res= 63.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
22.	Rt	Vishay-Dale	CRCW040228K0FKED Series= CRCW..e3	Res= 28.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Ruvb	Vishay-Dale	CRCW04026K34FKED Series= CRCW..e3	Res= 6.34 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	RC1206FR-073RL Series= ?	Res= 3.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2

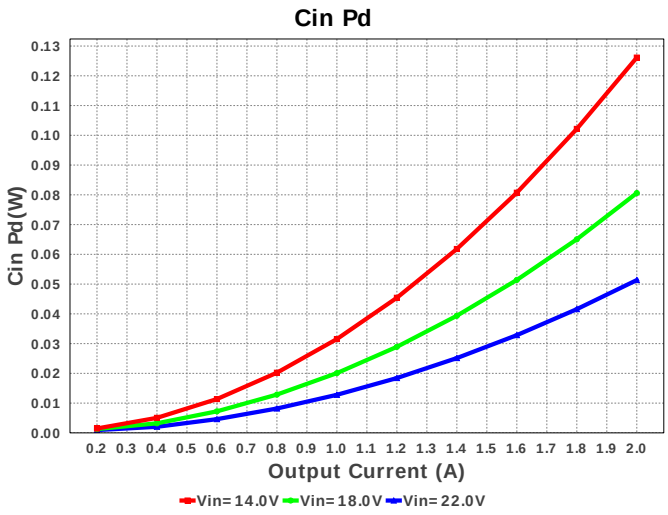
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	U1	Texas Instruments	LM5121MH/NOPB	Switcher	1	$2.46	 MXA20A 71 mm²

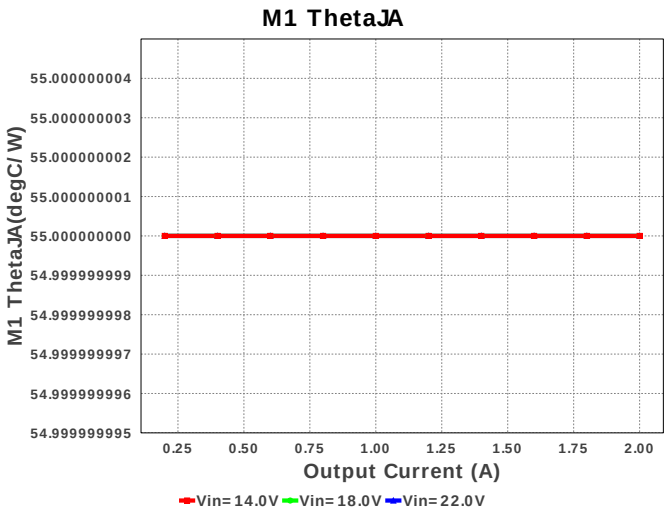


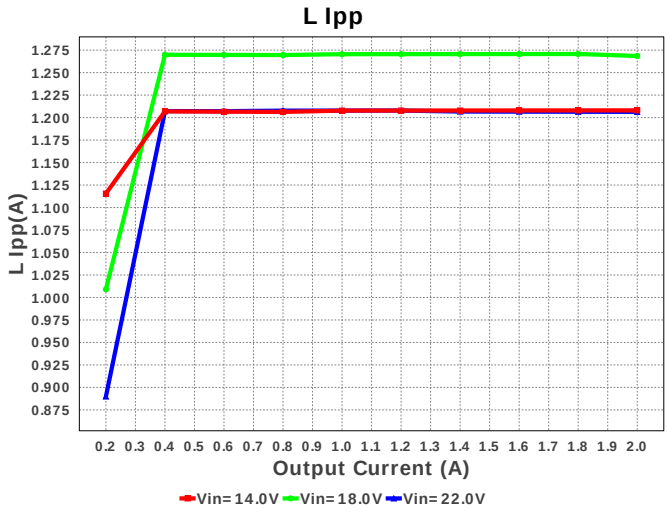


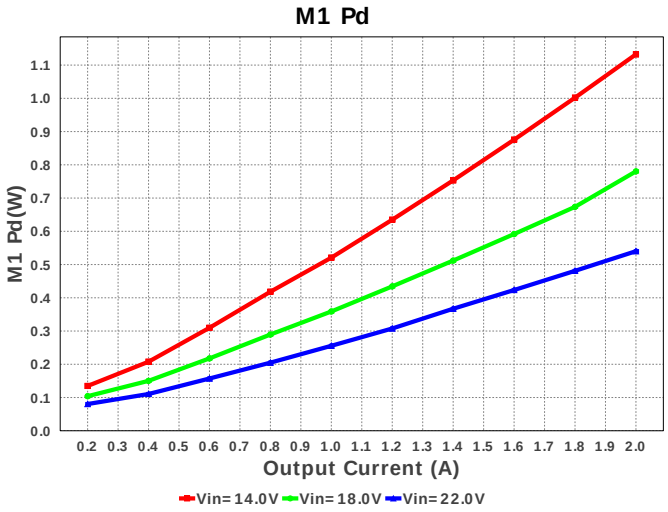


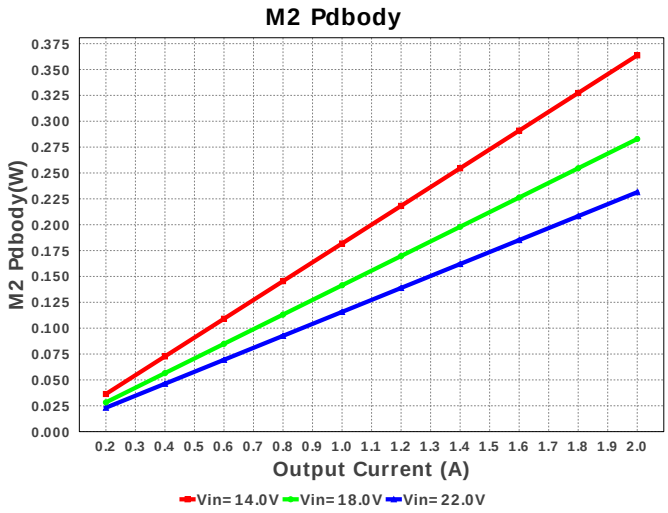


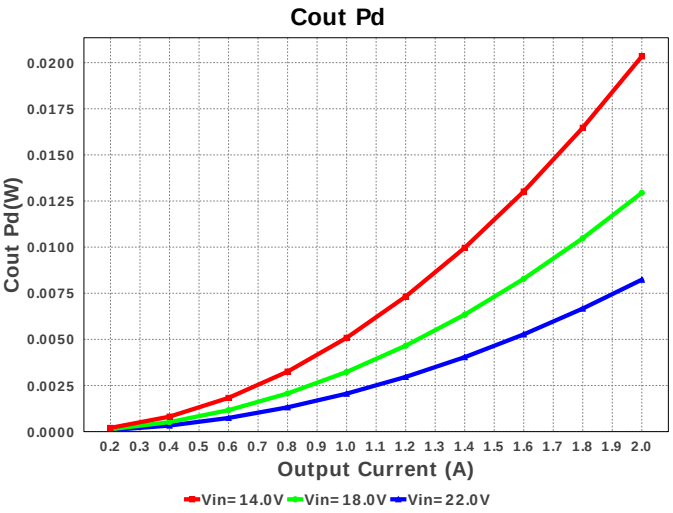




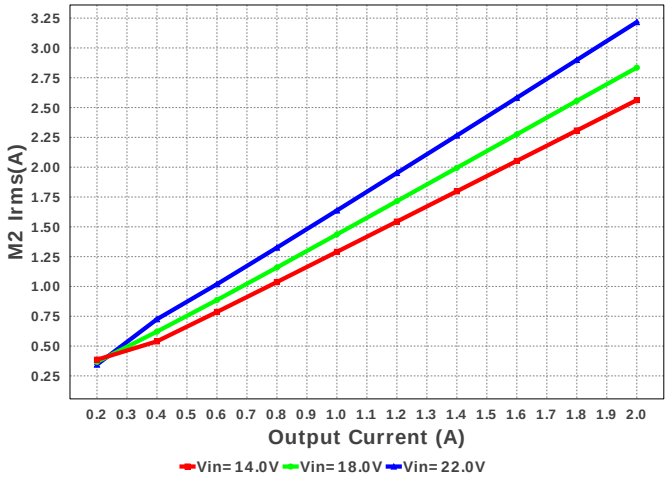




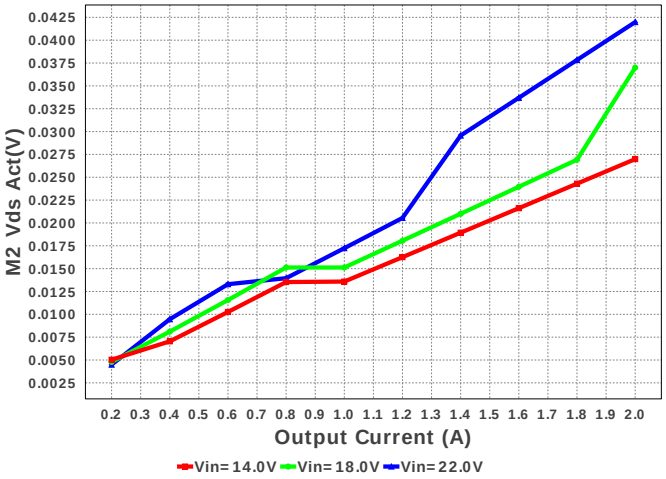




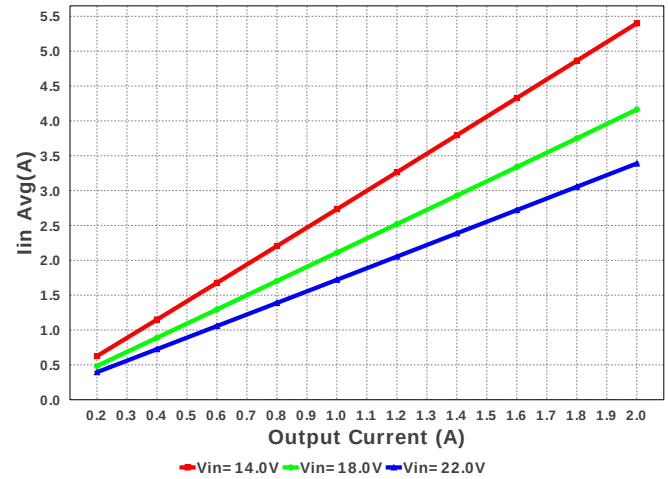
M2 Irms



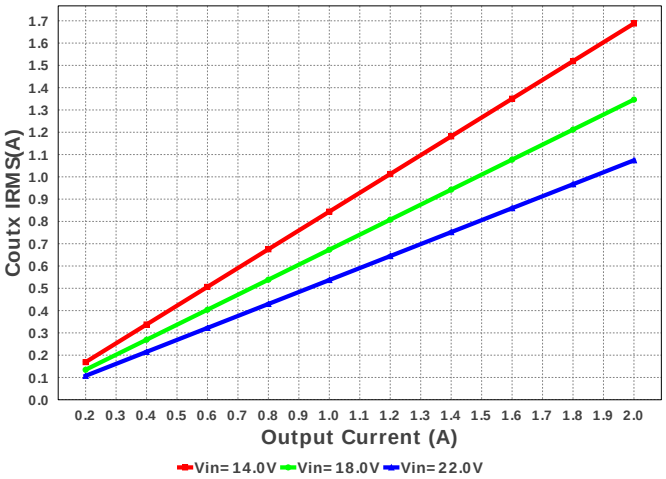
M2 Vds Act



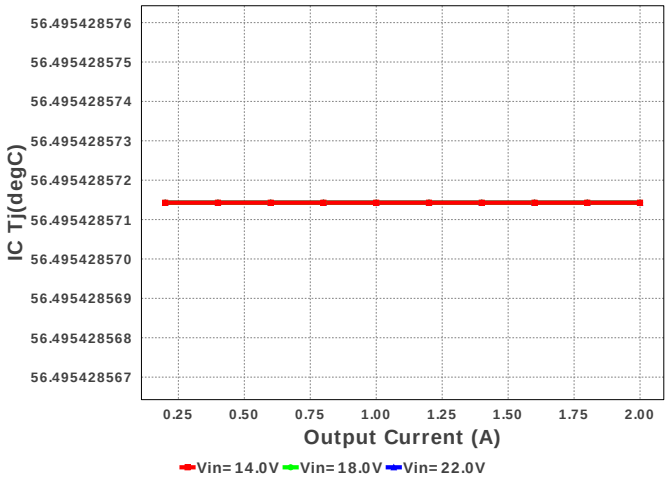
Iin Avg



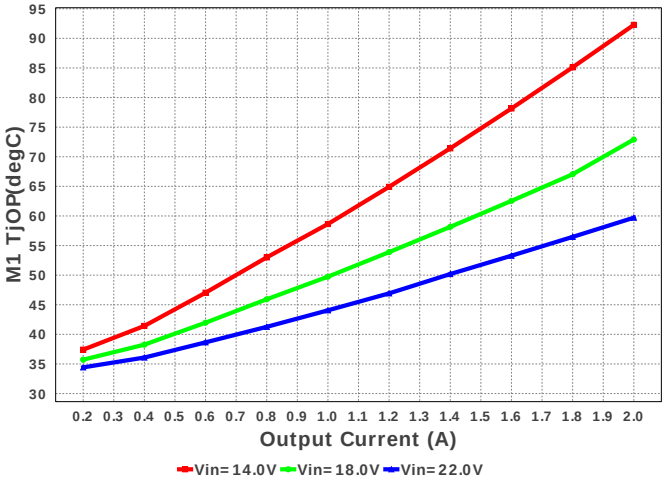
Coutx IRMS

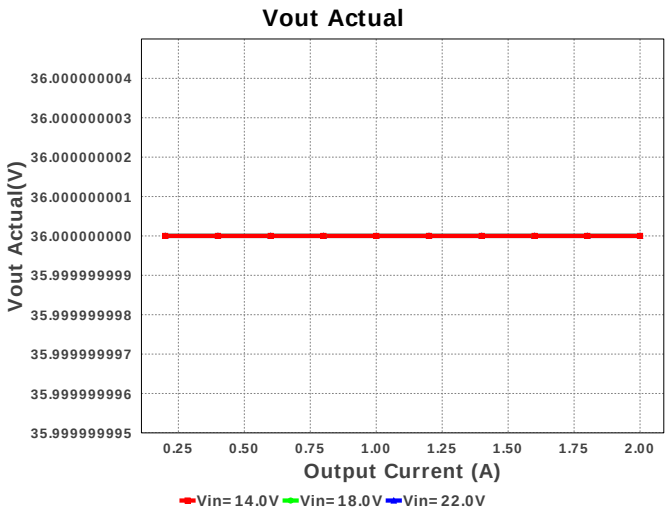


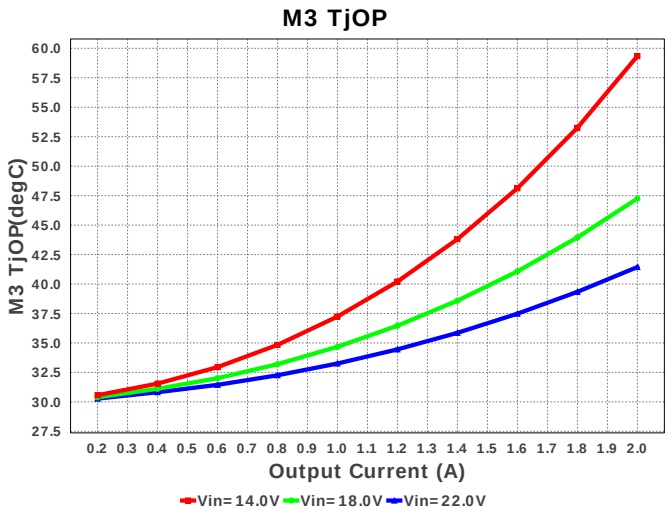
IC Tj

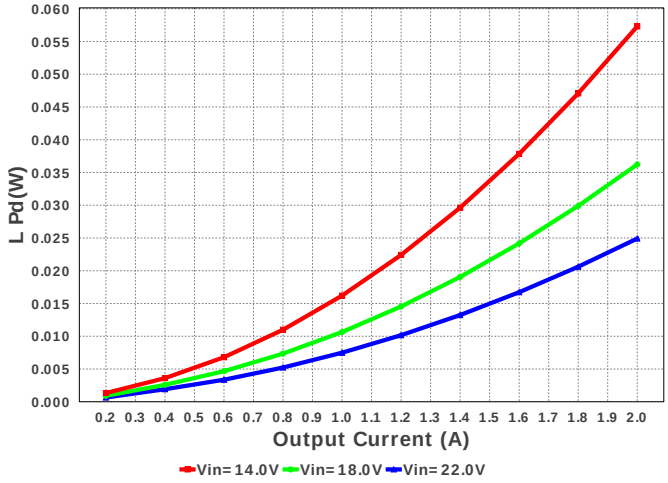


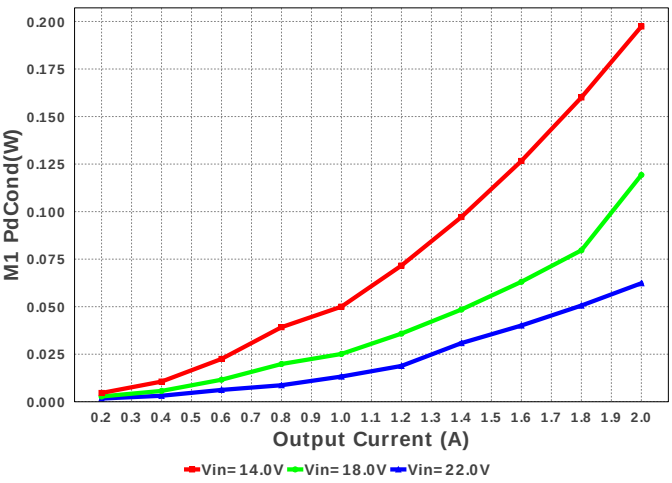
M1 TjOP

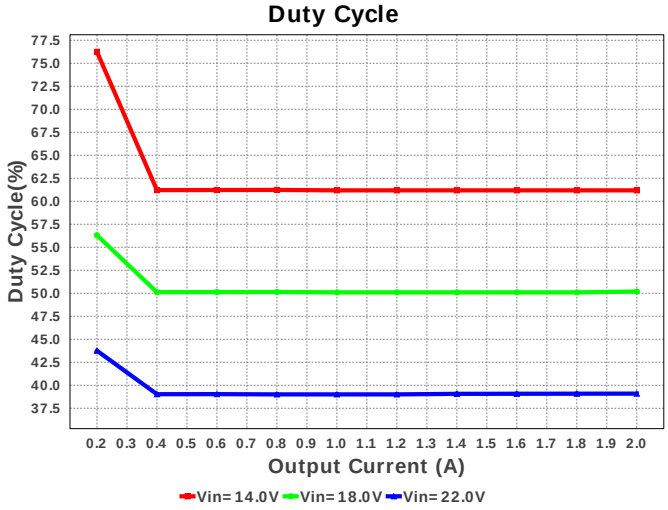


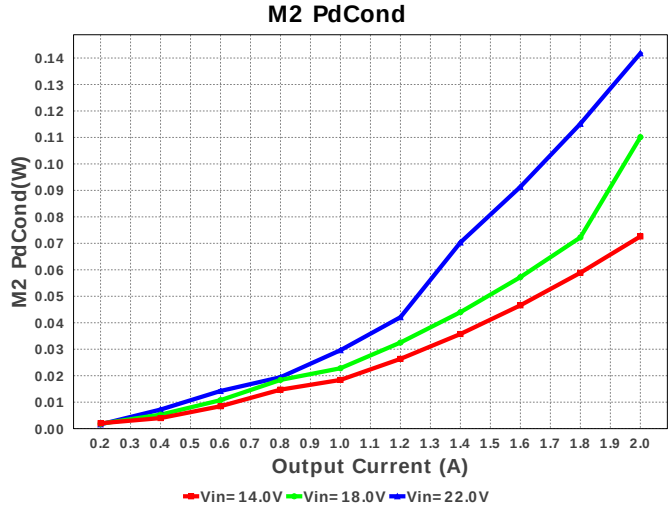


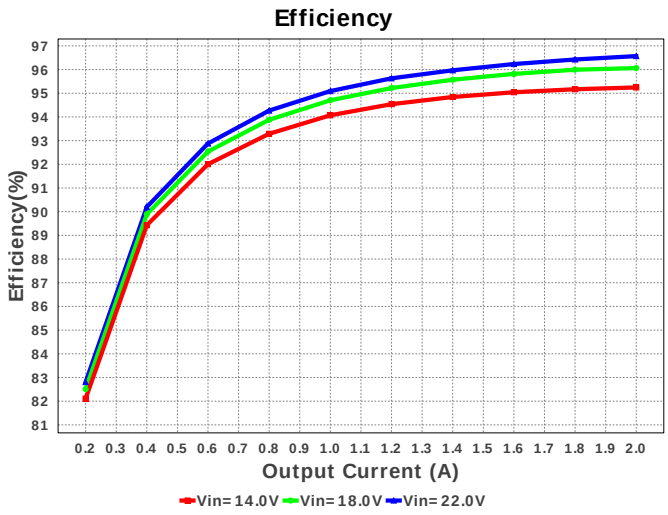


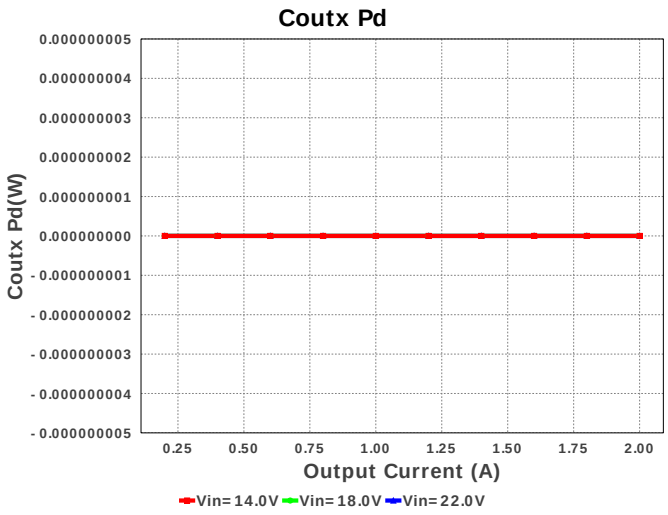


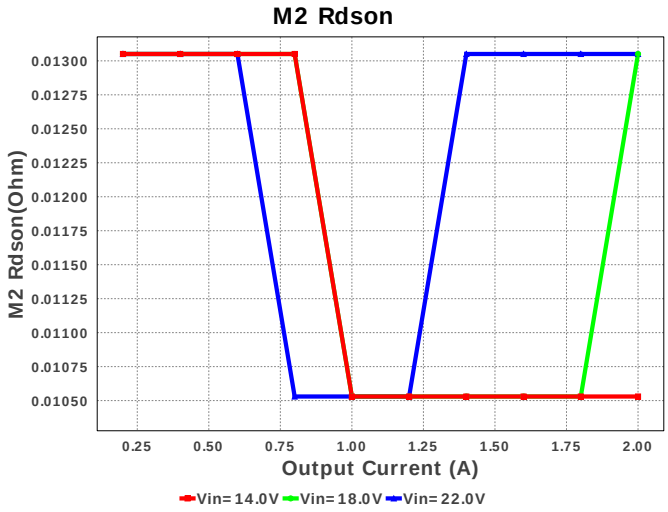


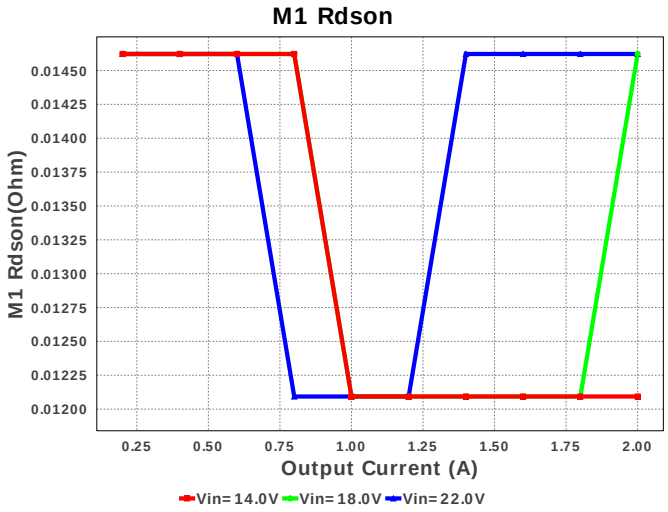


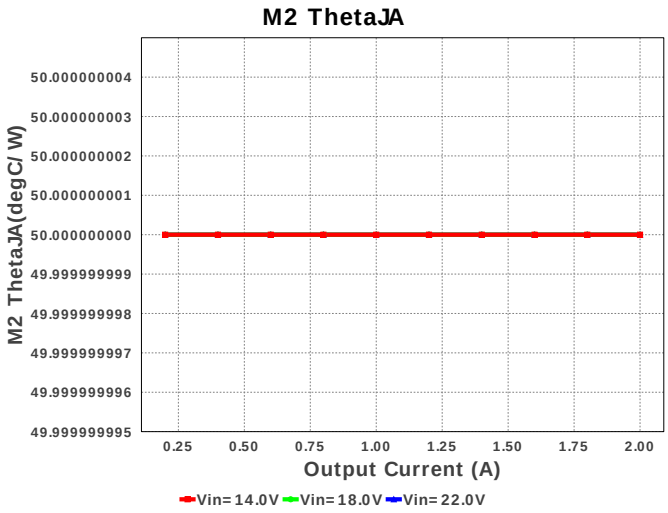


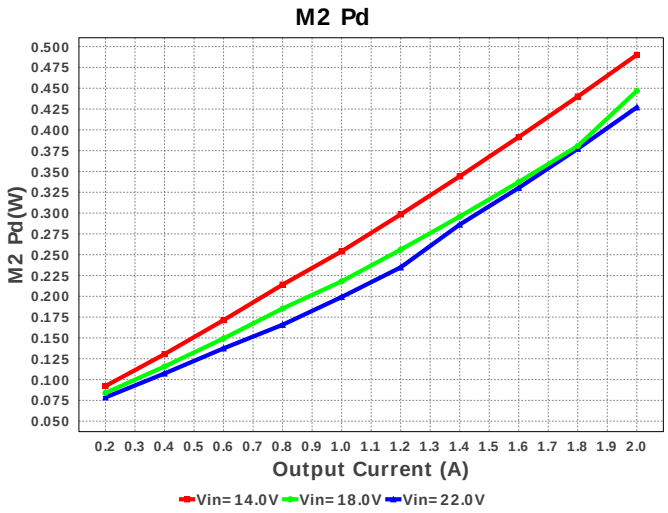


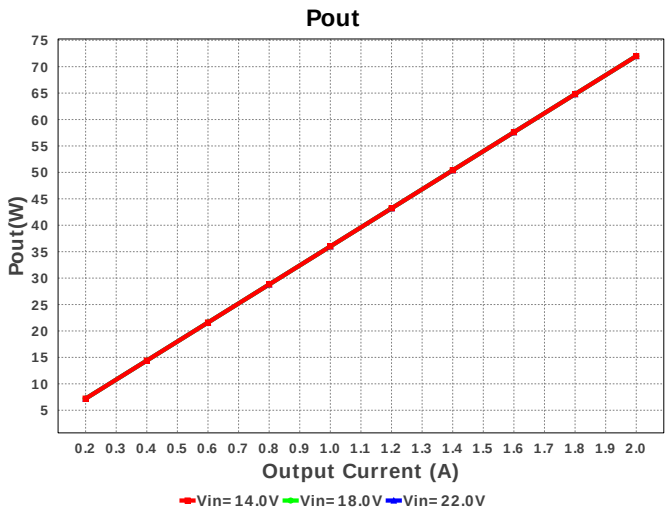


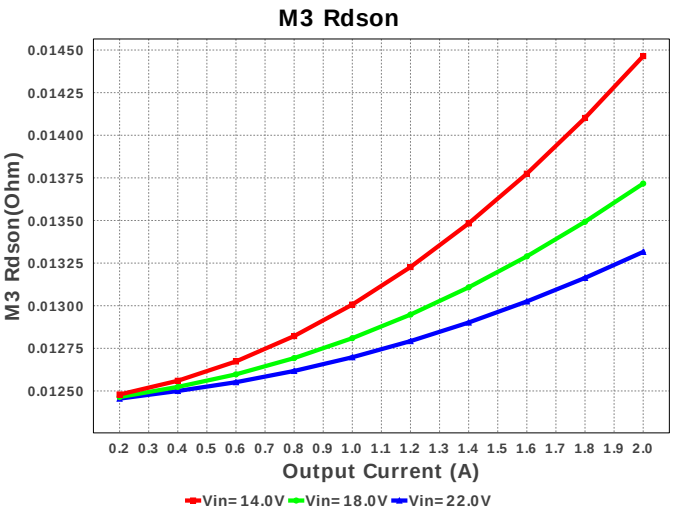


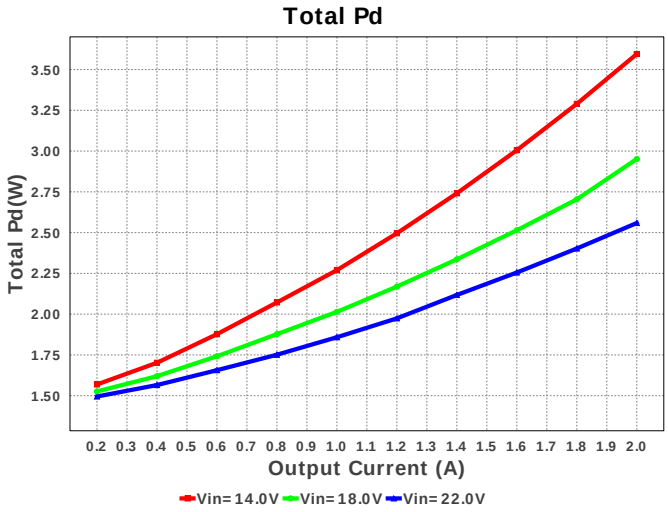


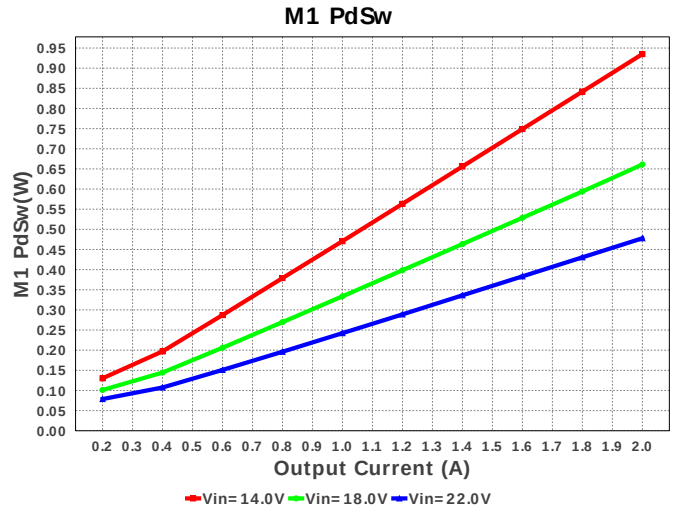


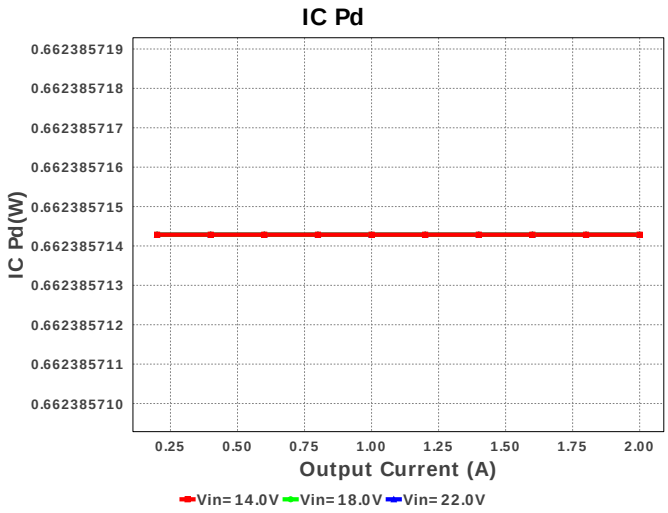


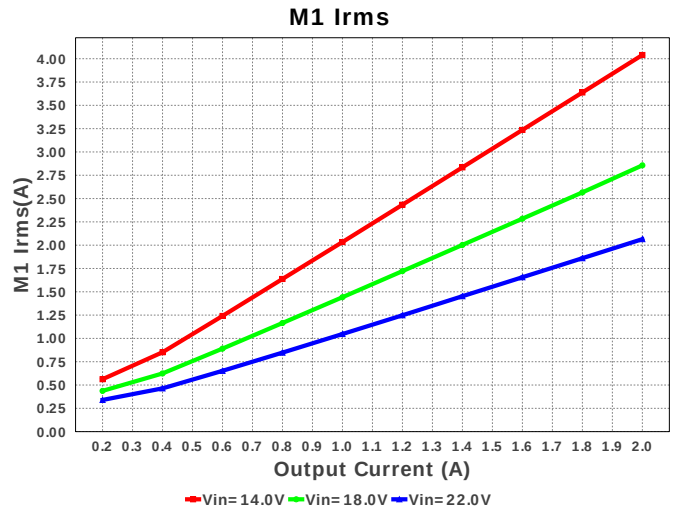


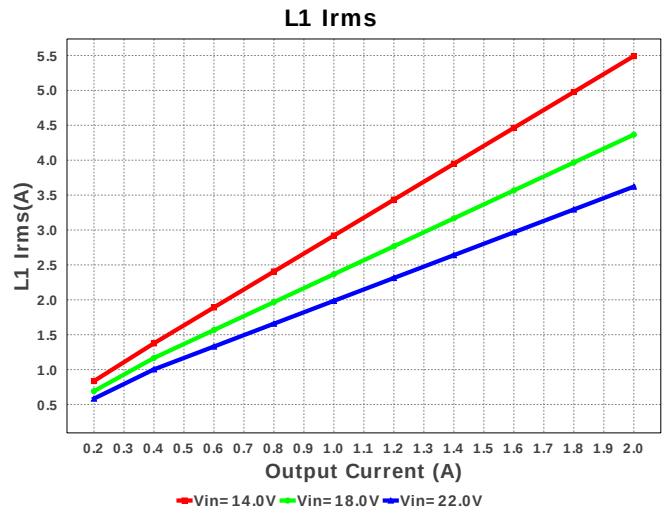


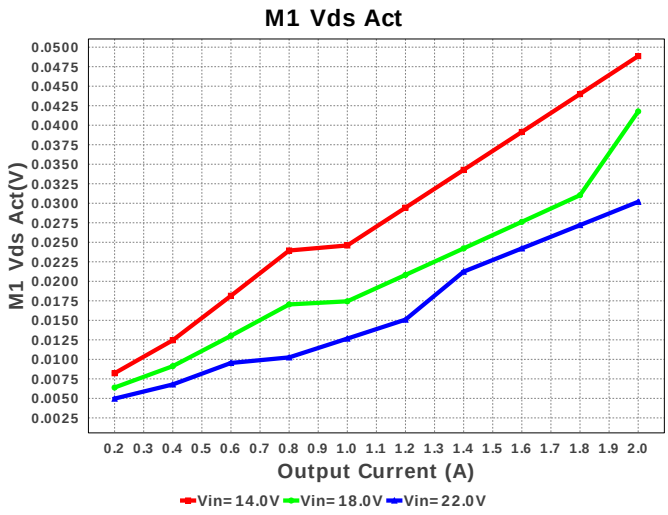


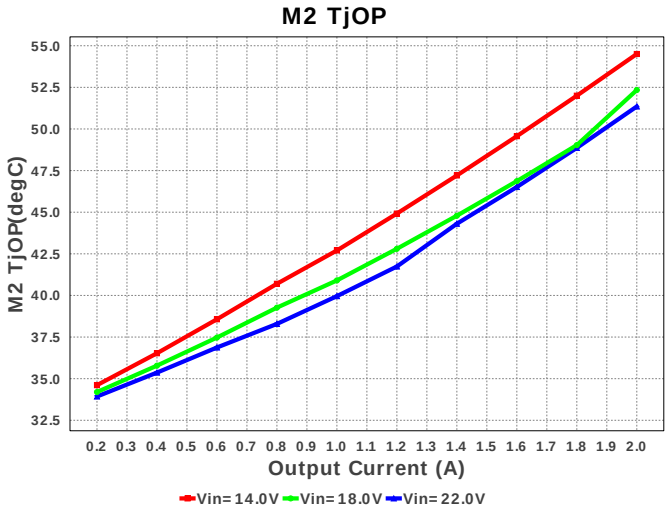


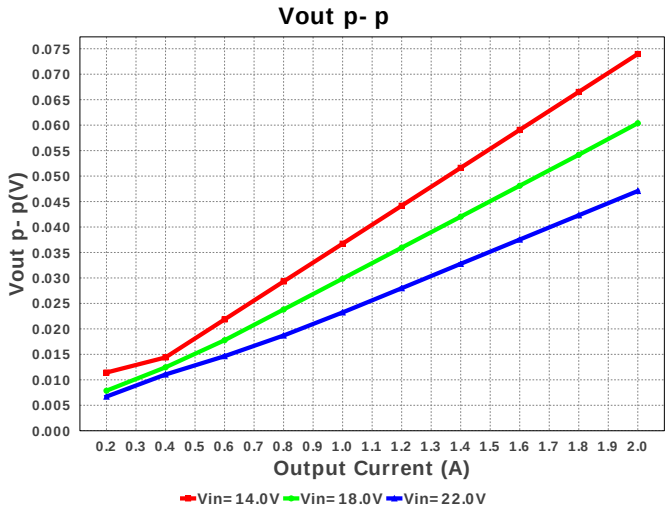


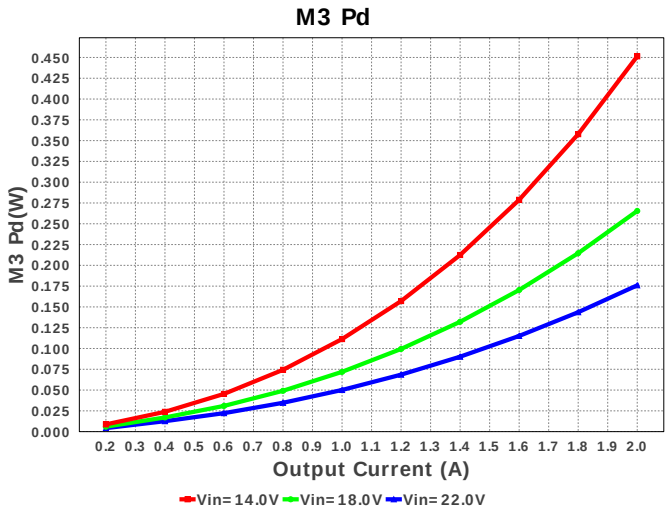


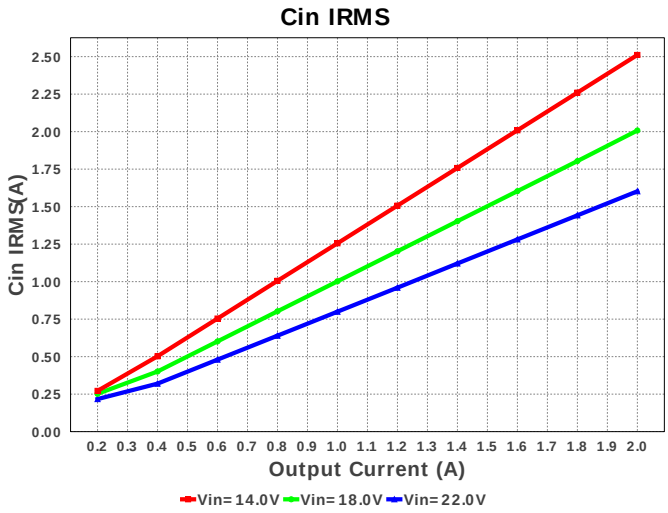












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.518 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	770.561 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	1.737 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	5.44 A	Current	Average input current
5.	L Ipp	1.204 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	5.49 A	Current	Inductor ripple current
7.	M1 Irms	4.058 A	Current	MOSFET RMS ripple current
8.	M2 Irms	2.56 A	Current	MOSFET RMS ripple current
9.	SW Ipk	5.773 A	Current	Peak switch current
10.	BOM Count	29	General	Total Design BOM count
11.	FootPrint	1.465 k mm^2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Frequency	321.429 kHz	General	Switching frequency
13.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
14.	M1 Rdson	12.093 mOhm	General	Drain-Source On-resistance
15.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	M2 Rdson	10.53 mOhm	General	Drain-Source On-resistance
17.	M2 ThetaJA	50.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
18.	M2 Vds Act	26.954 mV	General	M Vds
19.	Mode	CCM	General	Conduction Mode
20.	Pout	72.0 W	General	Total output power
21.	Total BOM	$0.0	General	Total BOM Cost
22.	M3 TjOp	70.602 degC	Op_Point	M3 MOSFET junction temperature
23.	Vout Actual	36.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
24.	Vout OP	36.0 V	Op_Point	Operational Output Voltage
25.	Duty Cycle	61.323 %	Op_point	Duty cycle
26.	Efficiency	94.545 %	Op_point	Steady state efficiency
27.	IC Tj	60.198 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	92.614 degC	Op_point	M1 MOSFET junction temperature
31.	M2 TjOP	54.496 degC	Op_point	MOSFET junction temperature
32.	VIN_OP	14.0 V	Op_point	Vin operating point
33.	Vout p-p	70.029 mV	Op_point	Peak-to-peak output ripple voltage
34.	Cin Pd	126.839 mW	Power	Input capacitor power dissipation
35.	Cout Pd	18.614 mW	Power	Output capacitor power dissipation
36.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
37.	IC Pd	754.957 mW	Power	IC power dissipation
38.	L Pd	57.274 mW	Power	Inductor power dissipation
39.	M1 Pd	1.138 W	Power	MOSFET power dissipation
40.	M1 Pd	1.138 W	Power	MOSFET power dissipation
41.	M1 PdCond	199.186 mW	Power	M1 MOSFET conduction losses
42.	M1 PdSw	939.246 mW	Power	M1 MOSFET switching losses
43.	M2 Pd	489.927 mW	Power	MOSFET power dissipation
44.	M2 PdCond	72.446 mW	Power	M2 MOSFET conduction losses
45.	M2 PdQrr	53.807 mW	Power	Synchronous Boost High Side Reverse Recovery
46.	M2 Pdbody	363.673 mW	Power	Power dissipation through lower FET
47.	M3 Pd	624.649 mW	Power	M3 MOSFET total power dissipation
48.	M3 Rdson	19.595 mOhm	Power	Drain-Source On-resistance
49.	Total Pd	4.154 W	Power	Total Power Dissipation
50.	M1 Vds Act	49.079 mV		M Vds
51.	M3 ThetaJA	65.0 degC/W		MOSFET junction-to-ambient thermal resistance
52.	Vout Tolerance	3.482 %		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	22.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	36.0	Output Voltage
5.	base_pn	LM5121	Base Product 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.