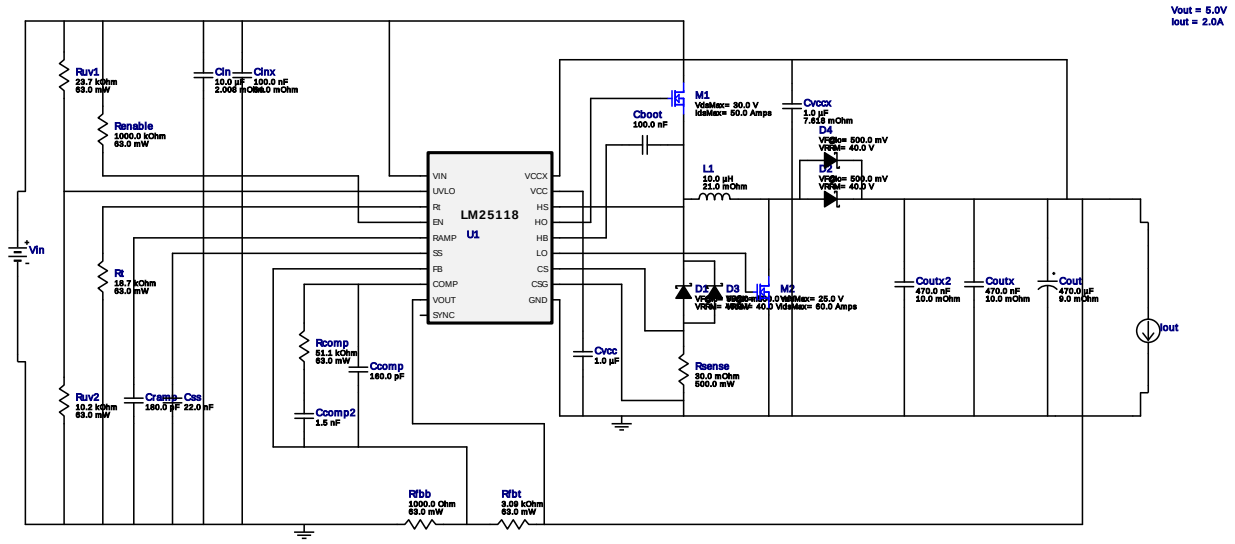
WEBENCH® Design Report

VinMin = 5.0V
VinMax = 22.0V
Vout = 5.0V
Iout = 2.0A

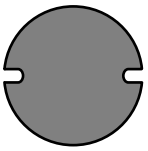
Device = LM25118MH/NOPB
Topology = Buck_Boost
Created = 7/13/16 11:48:23 PM
BOM Cost = $5.41
BOM Count = 28
Total Pd = 1.68W

Design : 4077713/3 LM25118MH/NOPB
LM25118MH/NOPB 5.0V-22.0V to 5.00V @ 2.0A

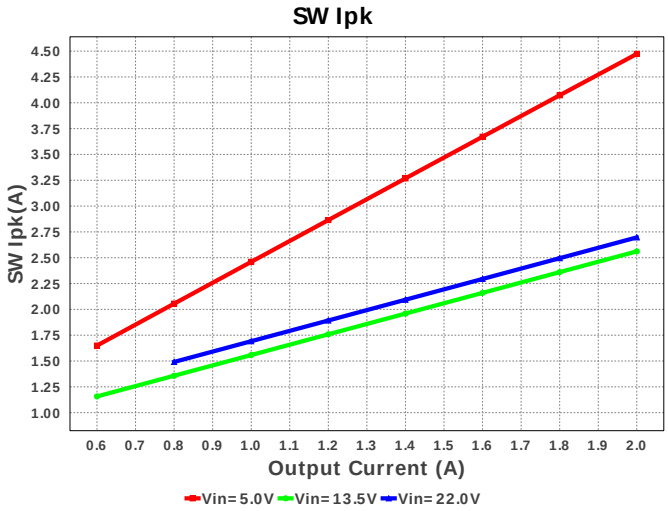


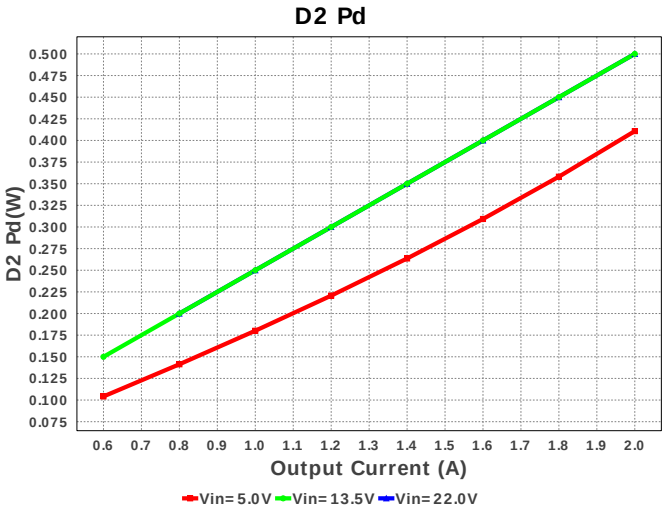
Electrical BOM

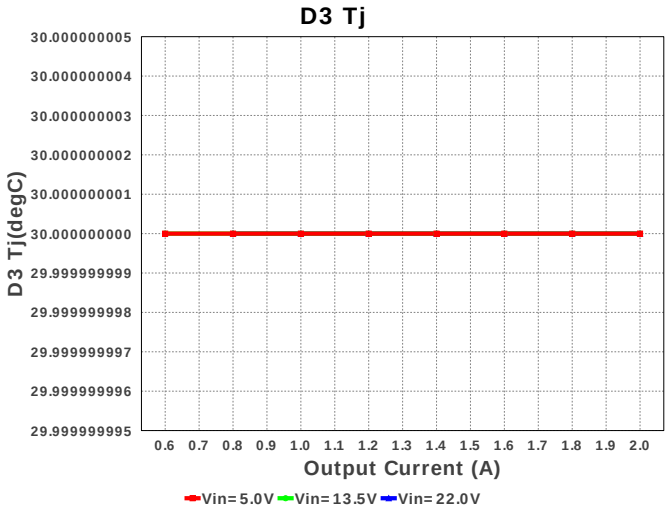
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	Samsung Electro-Mechanics	CL21C161JBANNNC Series= C0G/NP0	Cap= 160.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB152 Series= X7R	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	MuRata	GRM32ER7YA106KA12L Series= X7R	Cap= 10.0 uF ESR= 2.008 mOhm VDC= 35.0 V IRMS= 4.6772 A	1	$0.22	1210_280 15 mm²
5.	Cinx	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
6.	Cout	Chemi-Con	APXF6R3ARA471MH80G Series= PXF	Cap= 470.0 uF ESR= 9.0 mOhm VDC= 6.3 V IRMS= 4.5 A	1	$0.92	CAPSMT_62_H80 106 mm²
7.	Coutx	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 mm²
8.	Coutx2	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 mm²
9.	Cramp	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²

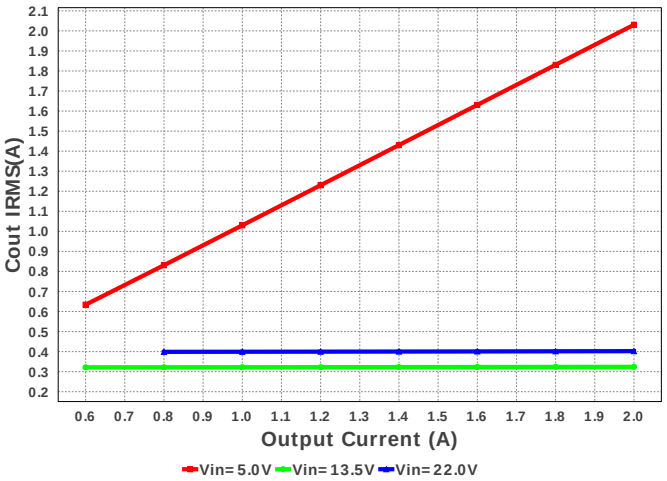
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Css	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm^2
11.	Cvcc	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0805 7 mm^2
12.	Cvccx	TDK	C1005X5R0J105M Series= X5R	Cap= 1.0 uF ESR= 7.618 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	 0402 3 mm^2
13.	D1	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.11	 SMA 37 mm^2
14.	D2	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.11	 SMA 37 mm^2
15.	D3	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.11	 SMA 37 mm^2
16.	D4	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.11	 SMA 37 mm^2
17.	L1	Bourns	SDR1307-100ML	L= 10.0 µH DCR= 21.0 mOhm	1	$0.35	 SDR1307 227 mm^2
18.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	$0.34	 TRANS_NexFET_Q3 18 mm^2
19.	M2	Texas Instruments	CSD16323Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.44	 TRANS_NexFET_Q3 18 mm^2
20.	Rcomp	Vishay-Dale	CRCW040251K1FKED Series= CRCW..e3	Res= 51.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
21.	Renable	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
22.	Rfbb	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Rfbt	Vishay-Dale	CRCW04023K09FKED Series= CRCW..e3	Res= 3.09 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
24.	Rsense	Stackpole Electronics Inc	CSR1206FK30L0 Series= ?	Res= 30.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.10	 1206 11 mm^2
25.	Rt	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
26.	Ruv1	Vishay-Dale	CRCW040223K7FKED Series= CRCW..e3	Res= 23.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
27.	Ruv2	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2

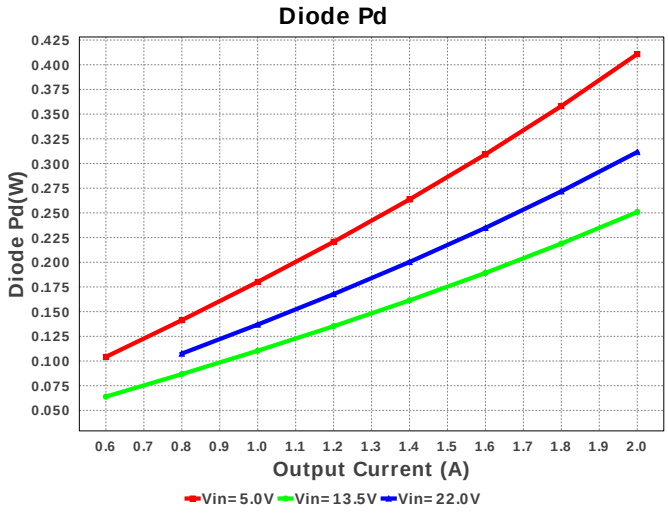
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	U1	Texas Instruments	LM25118MH/NOPB	Switcher	1	$2.40	 MXA20A 71 mm²

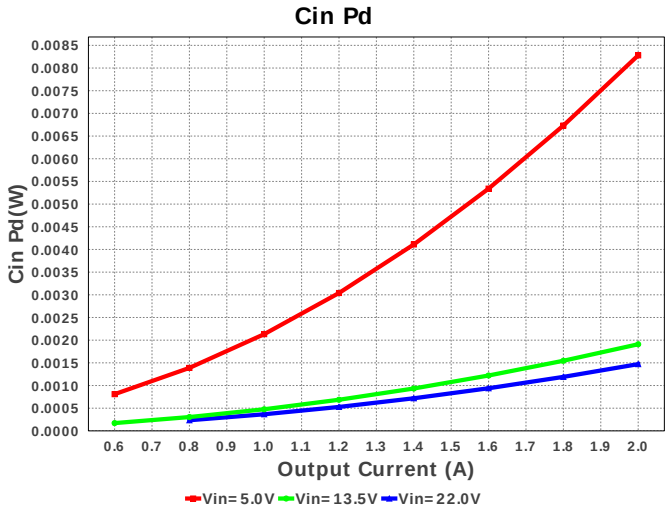


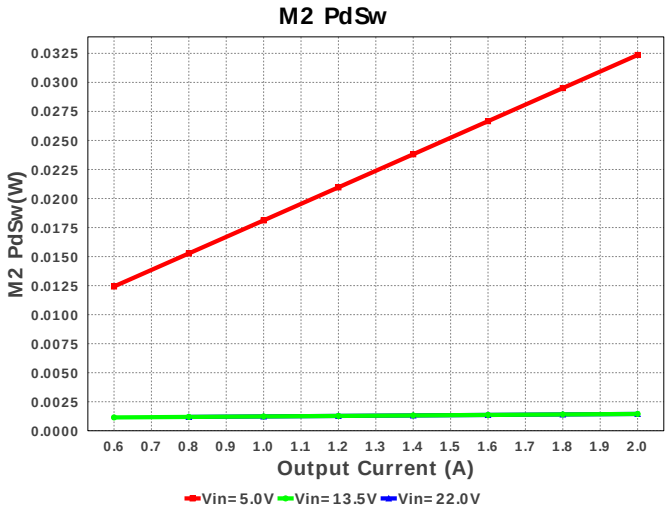


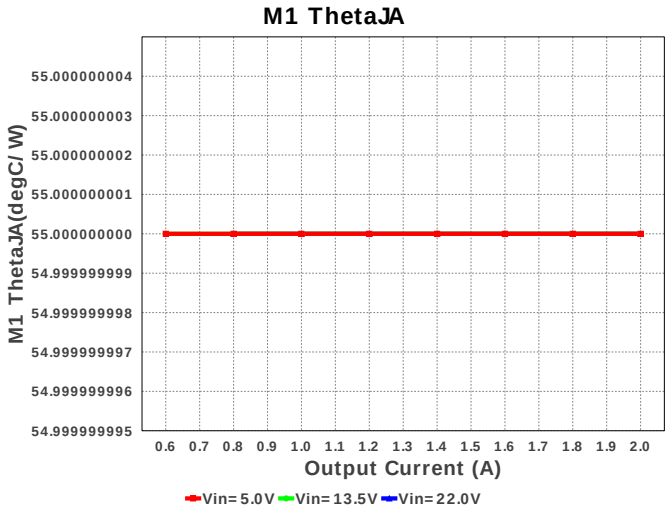


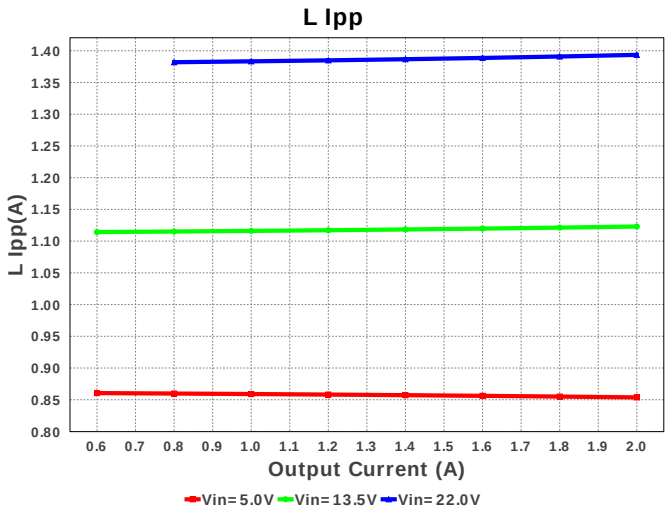


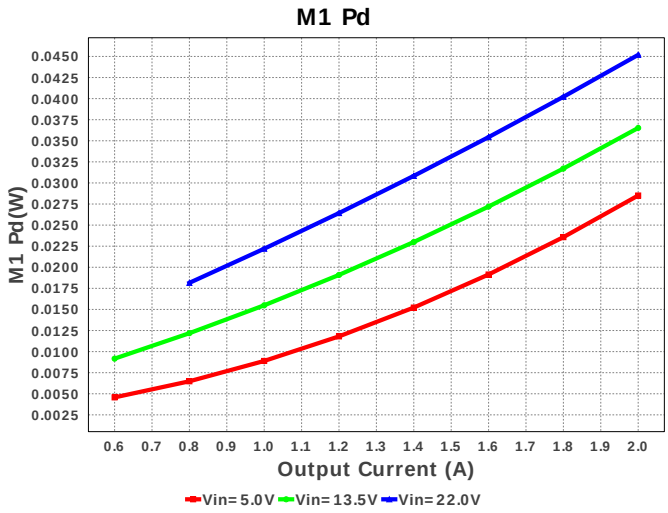


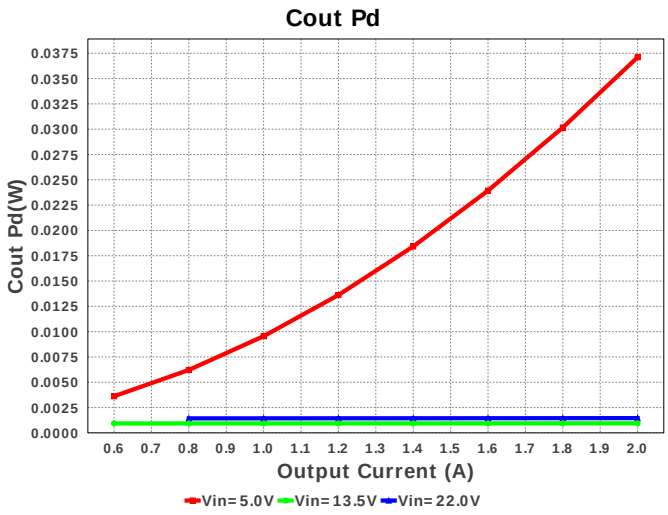


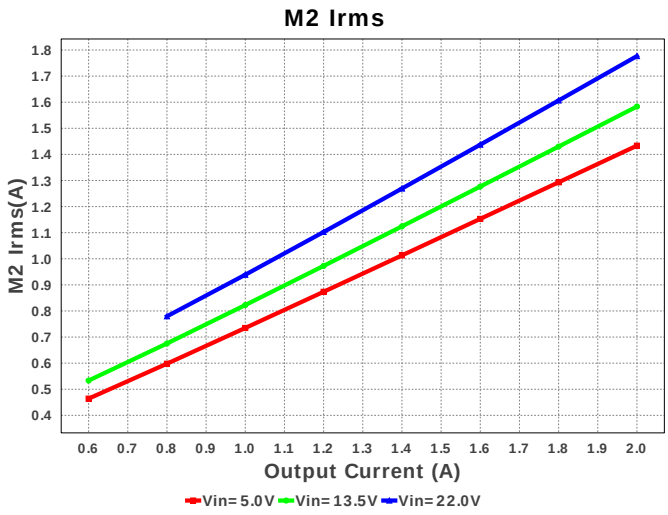


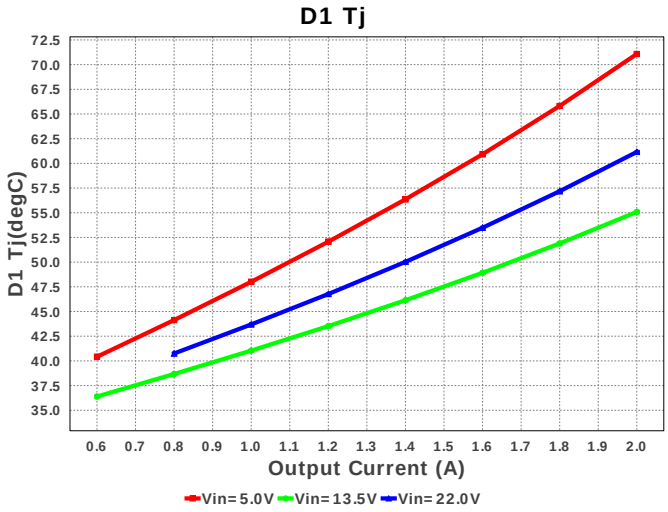


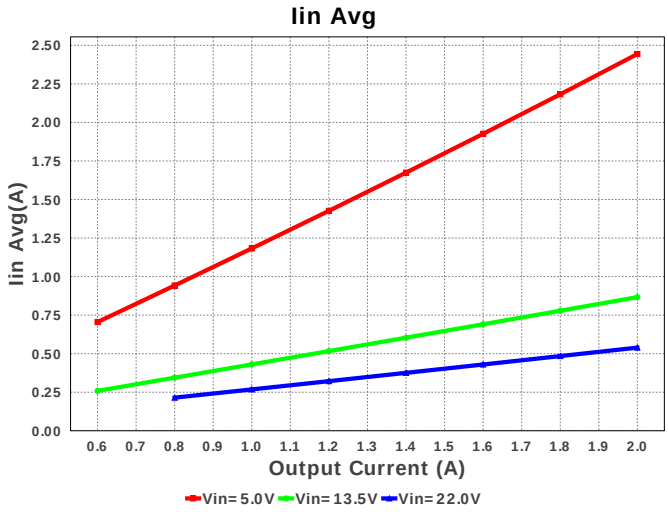


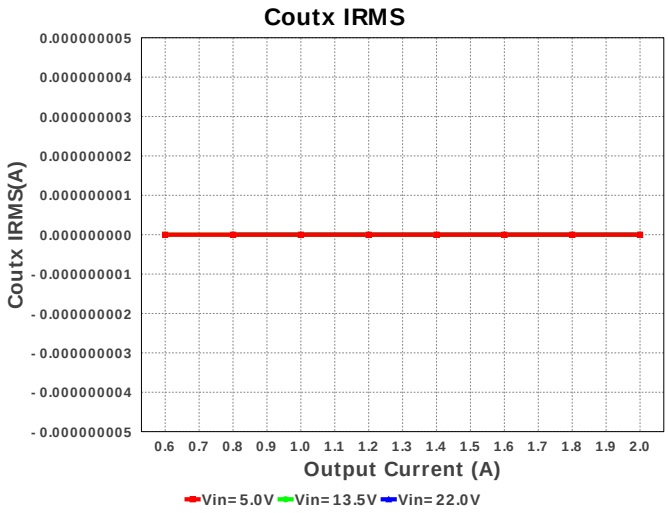


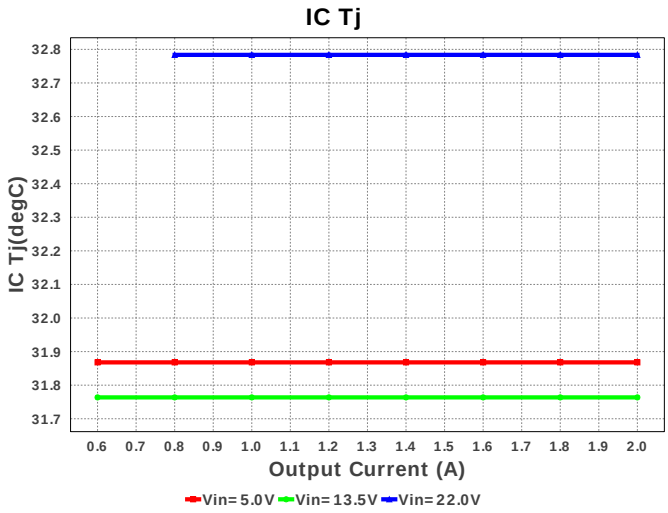


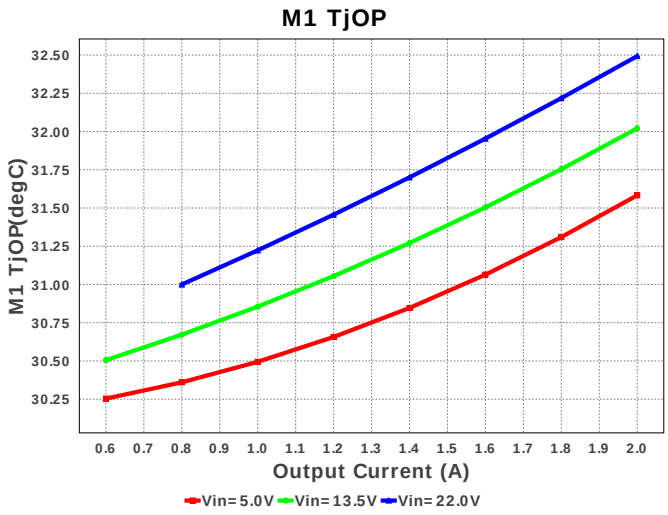


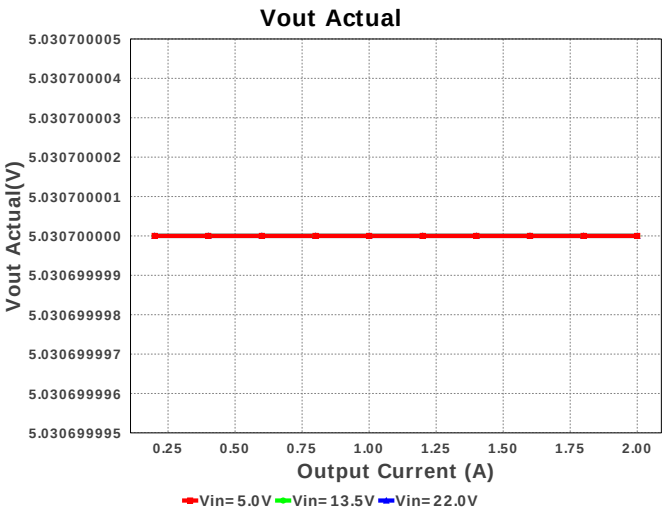


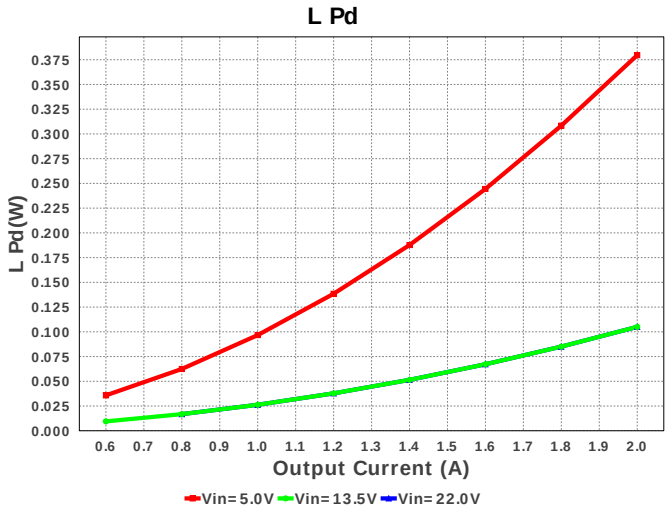


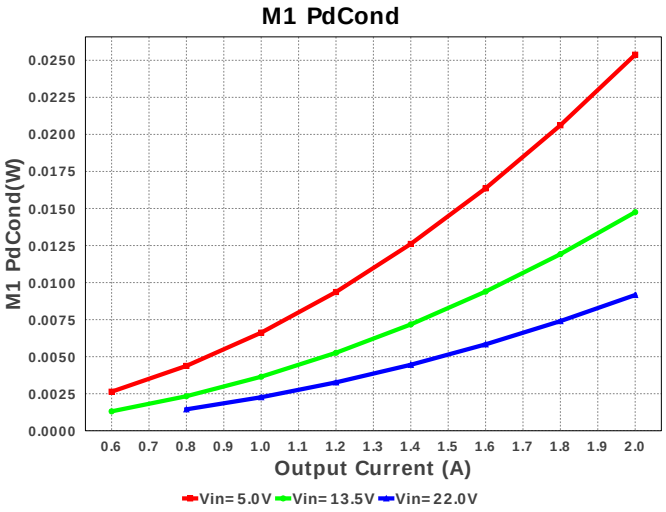


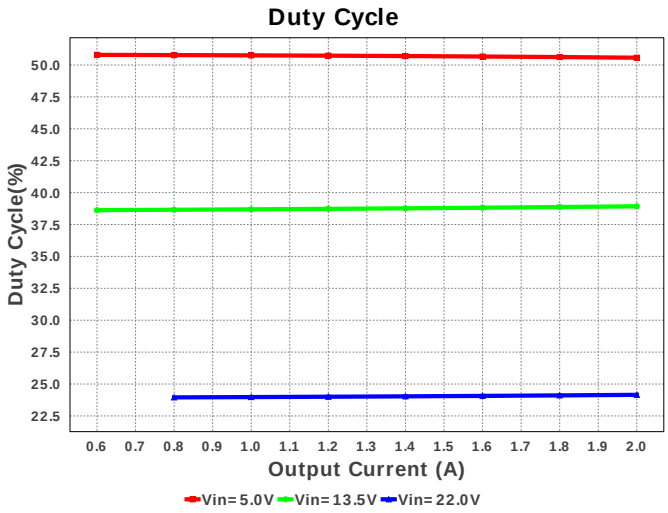


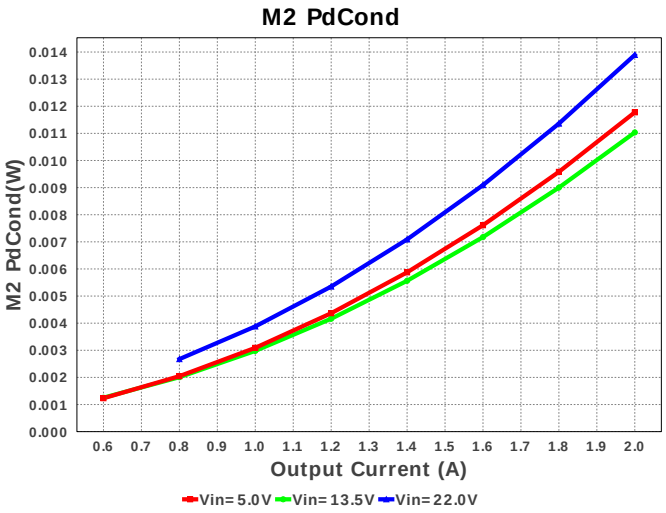


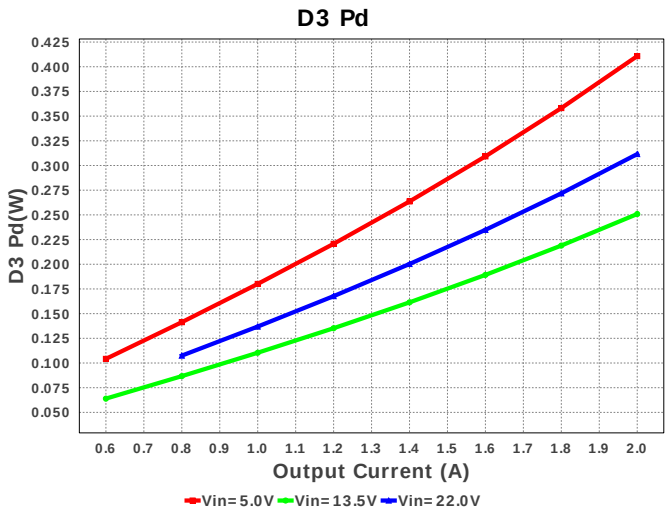


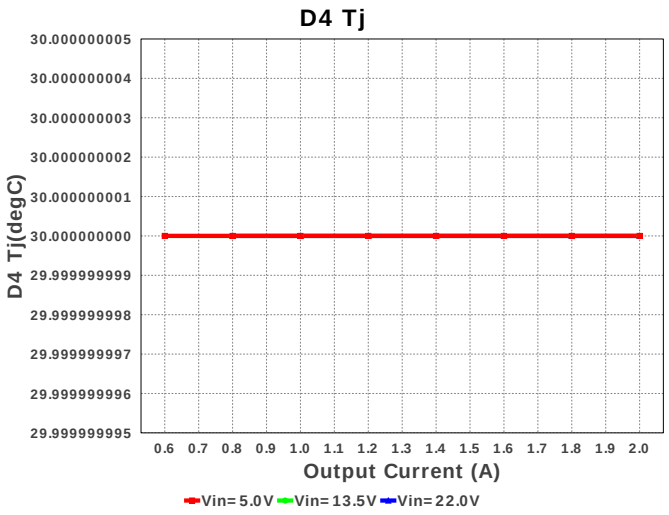


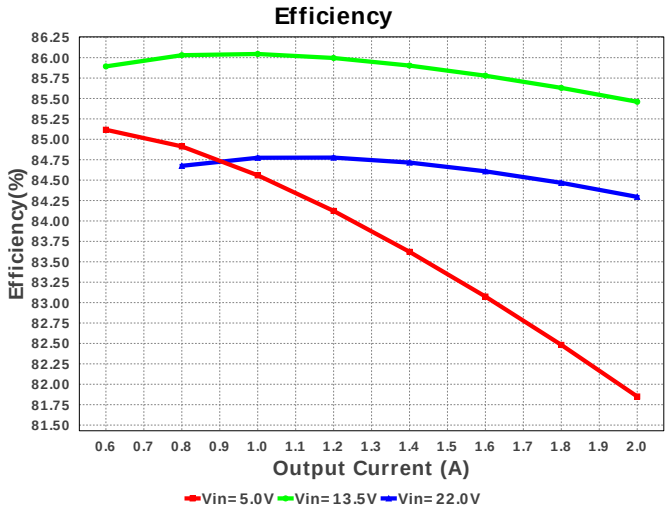


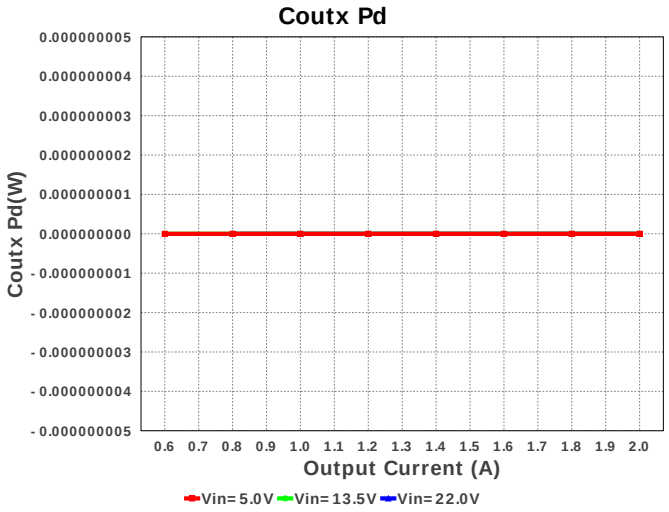


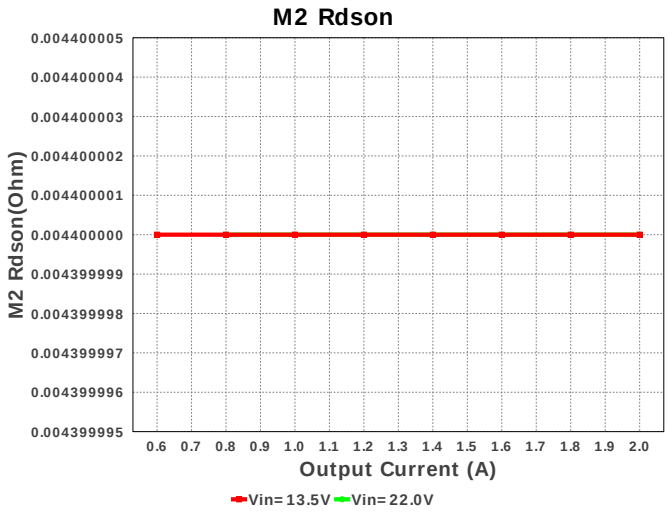


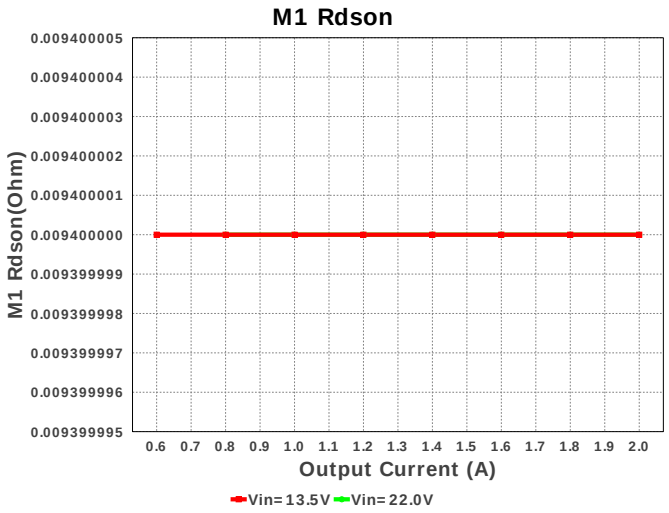


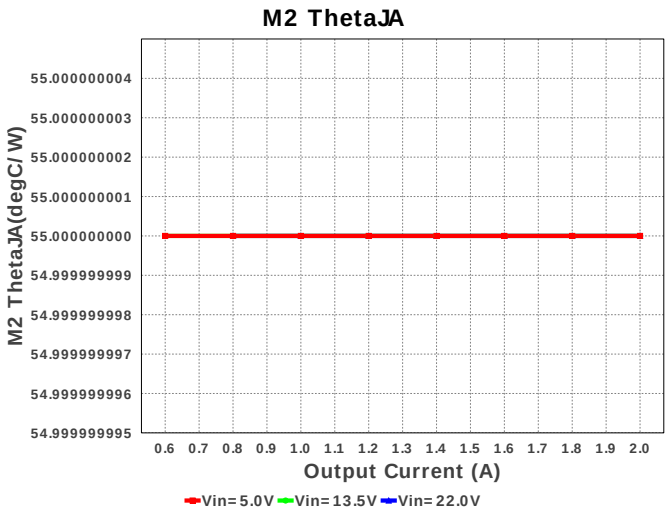


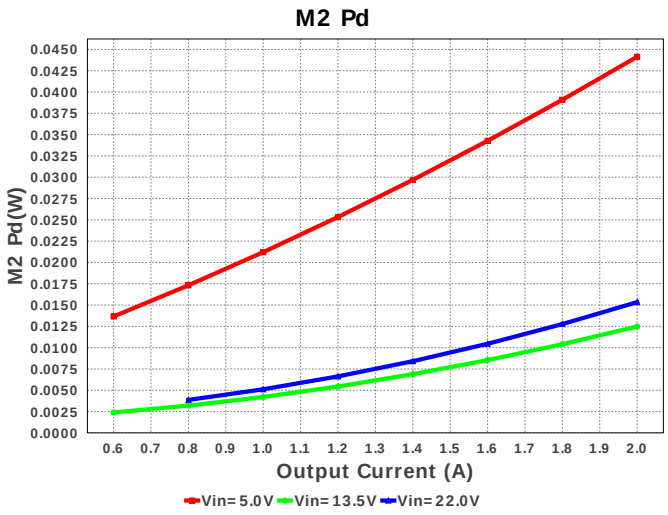


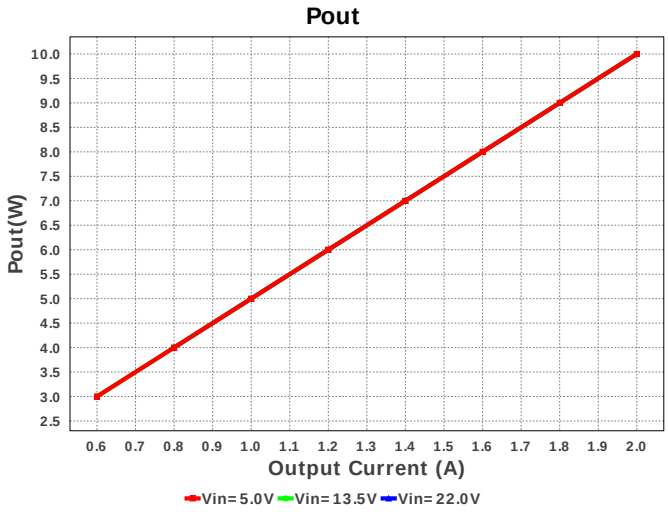


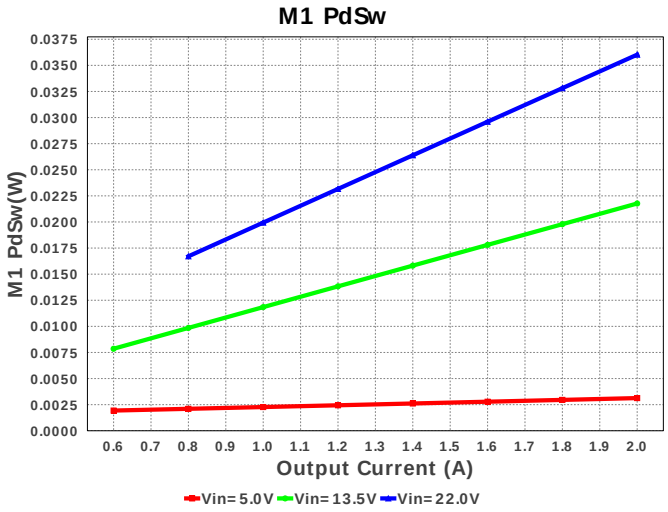


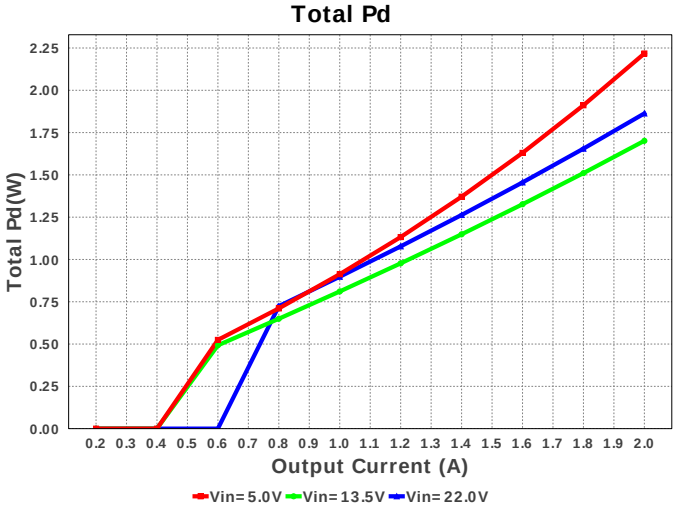


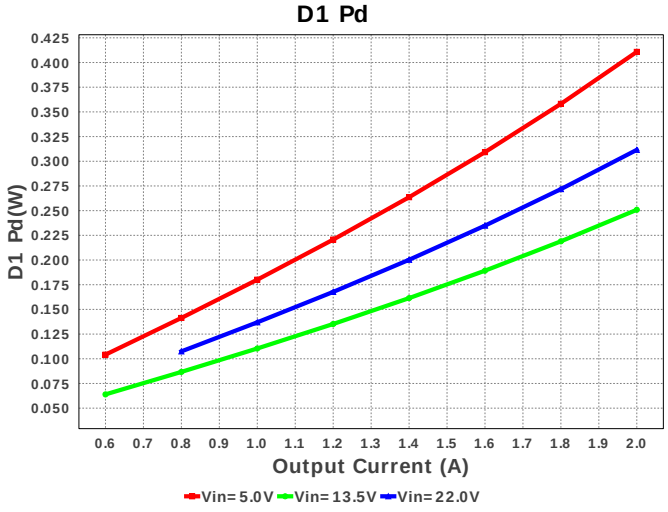


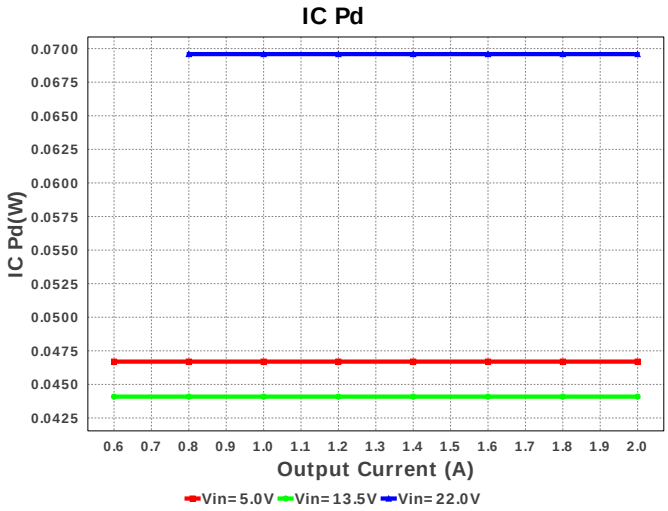


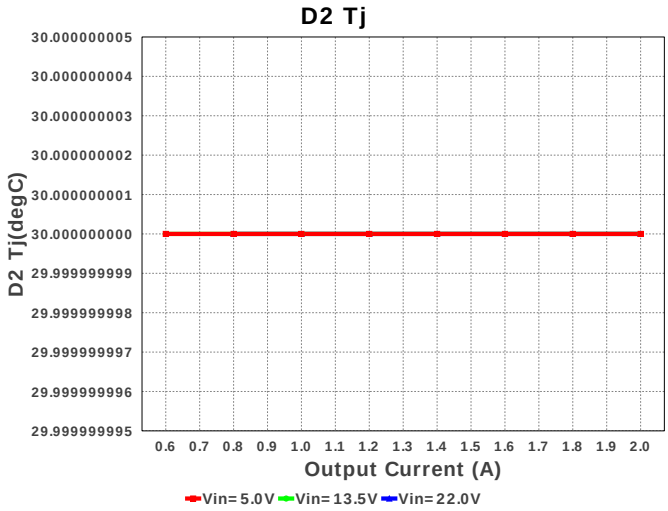


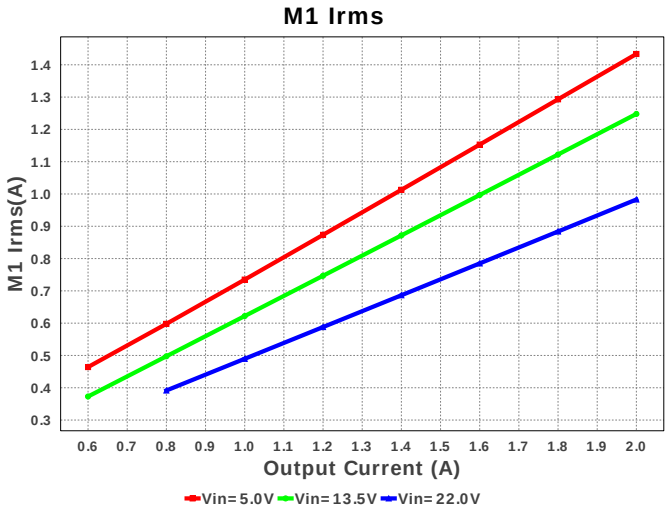


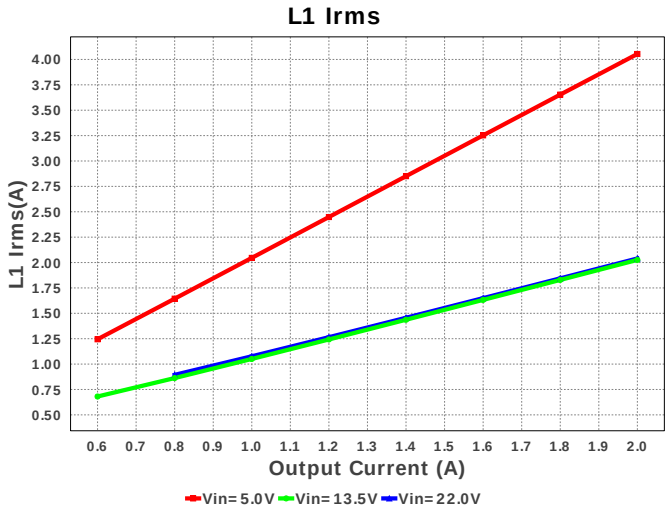


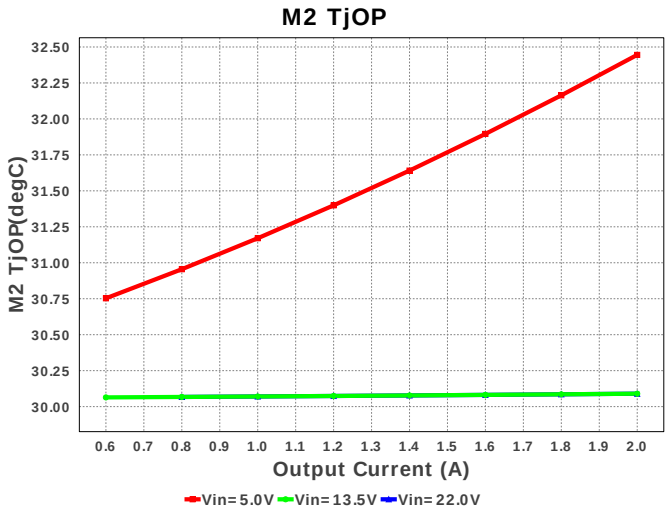


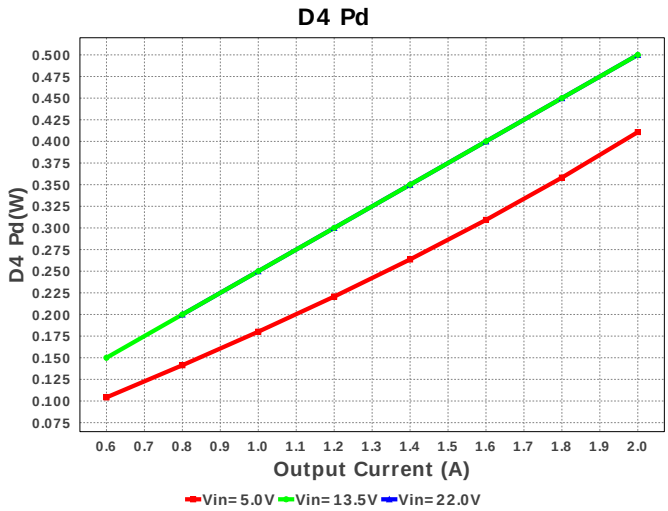


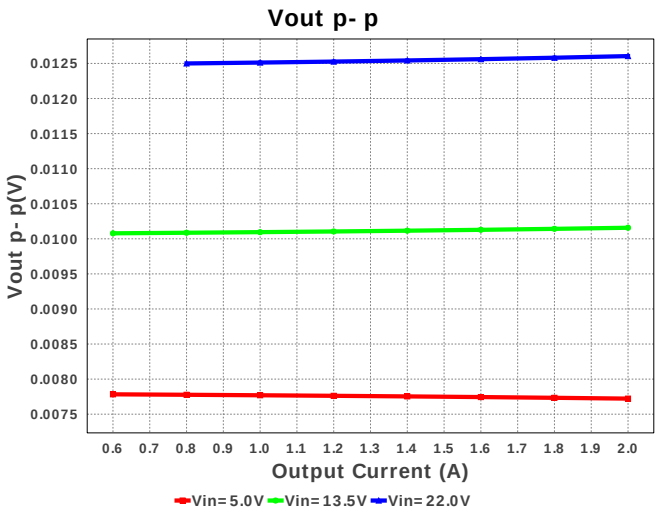


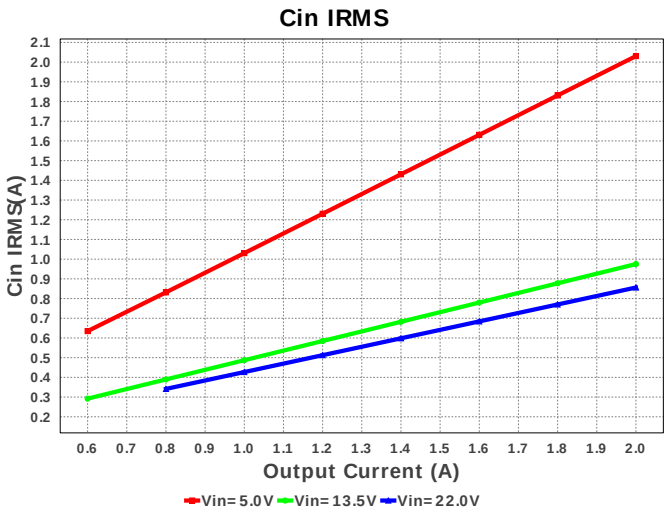


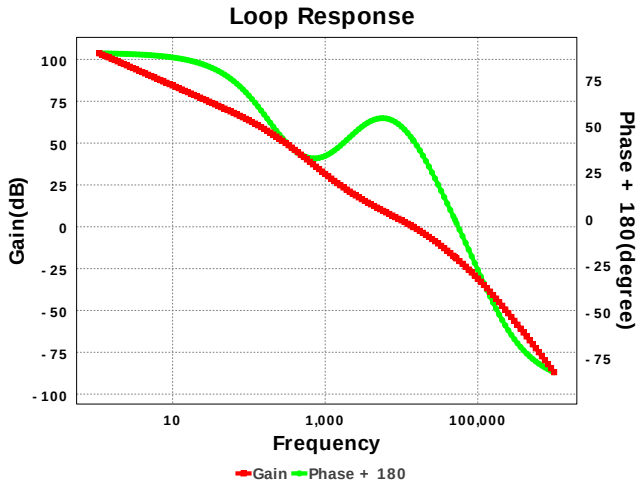












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	856.032 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	402.277 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	531.13 mA	Current	Average input current
5.	L Ipp	1.394 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	2.04 A	Current	Inductor ripple current
7.	M1 Irms	982.932 mA	Current	MOSFET RMS ripple current
8.	M2 Irms	1.777 A	Current	MOSFET RMS ripple current
9.	SW Ipk	2.697 A	Current	Peak switch current
10.	BOM Count	28	General	Total Design BOM count
11.	FootPrint	697.0 mm^2	General	Total Foot Print Area of BOM components
12.	Frequency	294.659 kHz	General	Switching frequency
13.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
14.	M1 Rdson	9.4 mOhm	General	Drain-Source On-resistance
15.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	M2 Rdson	4.4 mOhm	General	Drain-Source On-resistance
17.	M2 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
18.	Pout	10.0 W	General	Total output power
19.	Total BOM	$5.41	General	Total BOM Cost
20.	D1 Tj	61.156 degC	Op_Point	D1 junction temperature
21.	D1 Tj	61.156 degC	Op_Point	D1 junction temperature
22.	D2 Tj	71.078 degC	Op_Point	D2 junction temperature
23.	D3 Tj	61.156 degC	Op_Point	D3 junction temperature
24.	D4 Tj	71.078 degC	Op_Point	D4 junction temperature
25.	Low Freq Gain	103.652 dB	Op_Point	Gain at 10Hz
26.	Vout Actual	5.031 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
27.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
28.	Cross Freq	14.153 kHz	Op_point	Bode plot crossover frequency
29.	Duty Cycle	24.154 %	Op_point	Duty cycle
30.	Efficiency	85.581 %	Op_point	Steady state efficiency
31.	Gain Marg	-18.146 dB	Op_point	Bode Plot Gain Margin

#	Name	Value	Category	Description
32.	IC Tj	32.784 degC	Op_point	IC junction temperature
33.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
34.	IOUT_OP	2.0 A	Op_point	Iout operating point
35.	M1 TjOP	32.493 degC	Op_point	MOSFET junction temperature
36.	M2 TjOP	32.452 degC	Op_point	MOSFET junction temperature
37.	Phase Marg	43.036 deg	Op_point	Bode Plot Phase Margin
38.	VIN_OP	22.0 V	Op_point	Vin operating point
39.	Vout p-p	12.605 mV	Op_point	Peak-to-peak output ripple voltage
40.	Cin Pd	1.471 mW	Power	Input capacitor power dissipation
41.	Cout Pd	1.456 mW	Power	Output capacitor power dissipation
42.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
43.	D1 Pd	311.558 mW	Power	Diode power dissipation
44.	D2 Pd	410.776 mW	Power	Diode2 power dissipation
45.	D3 Pd	311.558 mW	Power	Diode3 power dissipation
46.	D4 Pd	410.776 mW	Power	Diode4 power dissipation
47.	Diode Pd	311.558 mW	Power	Diode power dissipation
48.	IC Pd	69.591 mW	Power	IC power dissipation
49.	L Pd	105.0 mW	Power	Inductor power dissipation
50.	M1 Pd	45.381 mW	Power	MOSFET power dissipation
51.	M1 PdCond	9.355 mW	Power	M1 MOSFET conduction losses
52.	M1 PdSw	36.026 mW	Power	M1 MOSFET switching losses
53.	M2 Pd	21.645 mW	Power	MOSFET power dissipation
54.	M2 PdCond	14.022 mW	Power	M2 MOSFET conduction losses
55.	M2 PdSw	7.622 mW	Power	M2 MOSFET switching losses
56.	Total Pd	1.685 W	Power	Total Power Dissipation
57.	Vout Tolerance	3.012 %		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	5.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM25118	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. The LM25118 is a wide range buck-boost controller which is operable in an ultra wide input range of 3 to 75V. A buck-boost regulator can maintain regulation for input voltages either higher or lower than the output voltage. The challenge is that buck-boost power converters are not as efficient as buck regulators. The LM5118 has been designed as a dual mode controller whereby the power converter acts as a buck regulator while the input voltage is above the output. As the input voltage approaches the output voltage, a gradual transition to the buck-boost mode occurs. This gradual transition between modes eliminates disturbances at the output during transitions.

2. **LM25118** Product Folder : http://www.ti.com/product/LM25118 : contains the data sheet and other resources.