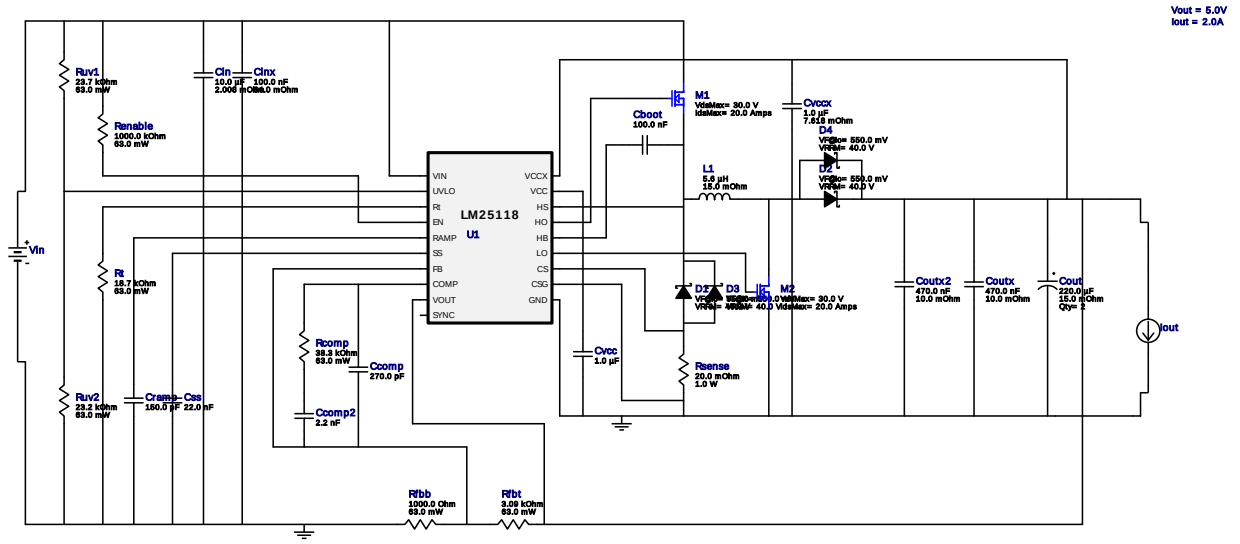
WEBENCH® Design Report

VinMin = 3.0V
VinMax = 22.0V
Vout = 5.0V
Iout = 2.0A

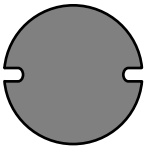
Device = LM25118MH/NOPB
Topology = Buck_Boost
Created = 8/1/16 4:11:30 AM
BOM Cost = $5.36
BOM Count = 29
Total Pd = 1.87W

Design : 4757020/1 LM25118MH/NOPB
LM25118MH/NOPB 3.0V-22.0V to 5.00V @ 2.0A

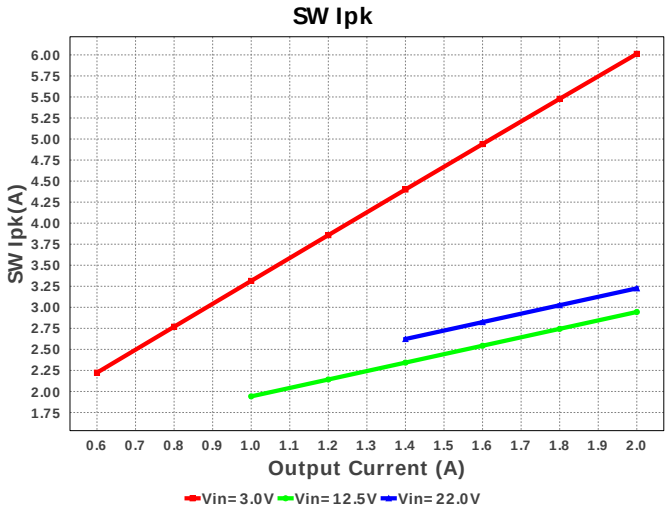


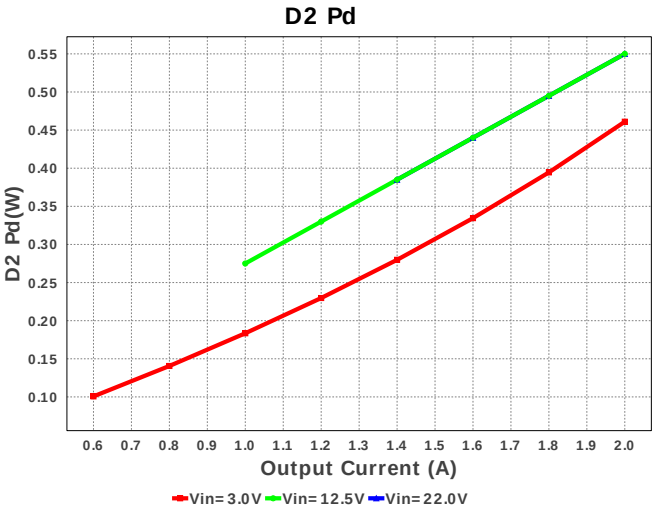
Electrical BOM

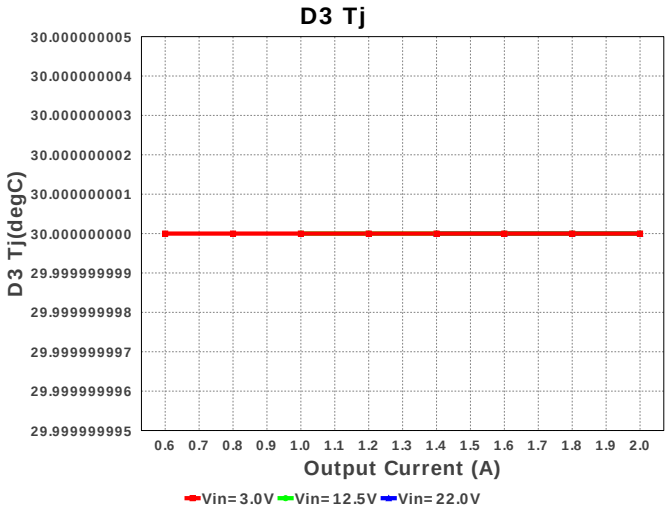
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	Yageo America	CC0805KRX7R9BB271 Series= X7R	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 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	APXE6R3ARA221MF61G Series= PXE	Cap= 220.0 uF ESR= 15.0 mOhm VDC= 6.3 V IRMS= 3.16 A	2	$0.43	CAPSMT_62_F61 74 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	TDK	C2012C0G1H151J Series= C0G/NP0	Cap= 150.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²

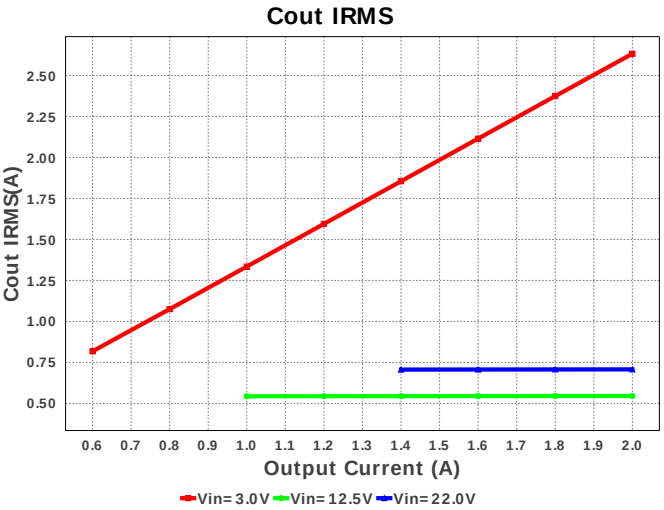
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Css	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
11.	Cvcc	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0805 7 mm²
12.	Cvccx	TDK	C1005X5R0J105M Series= X5R	Cap= 1.0 uF ESR= 7.618 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
13.	D1	Diodes Inc.	B540C-13-F	VF@Io= 550.0 mV VRRM= 40.0 V	1	$0.17	 SMC 83 mm²
14.	D2	Diodes Inc.	B540C-13-F	VF@Io= 550.0 mV VRRM= 40.0 V	1	$0.17	 SMC 83 mm²
15.	D3	Diodes Inc.	B540C-13-F	VF@Io= 550.0 mV VRRM= 40.0 V	1	$0.17	 SMC 83 mm²
16.	D4	Diodes Inc.	B540C-13-F	VF@Io= 550.0 mV VRRM= 40.0 V	1	$0.17	 SMC 83 mm²
17.	L1	Bourns	SDR1307-5R6ML	L= 5.6 µH DCR= 15.0 mOhm	1	$0.35	 SDR1307 227 mm²
18.	M1	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	$0.23	 TRANS_NexFET_Q3A 18 mm²
19.	M2	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	$0.23	 TRANS_NexFET_Q3A 18 mm²
20.	Rcomp	Vishay-Dale	CRCW040238K3FKED Series= CRCW..e3	Res= 38.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Renable	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
22.	Rfbb	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
23.	Rfbt	Vishay-Dale	CRCW04023K09FKED Series= CRCW..e3	Res= 3.09 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
24.	Rsense	Susumu Co Ltd	PRL1632-R020-F-T1 Series= PRL1632	Res= 20.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	 0612 11 mm²
25.	Rt	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
26.	Ruv1	Vishay-Dale	CRCW040223K7FKED Series= CRCW..e3	Res= 23.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

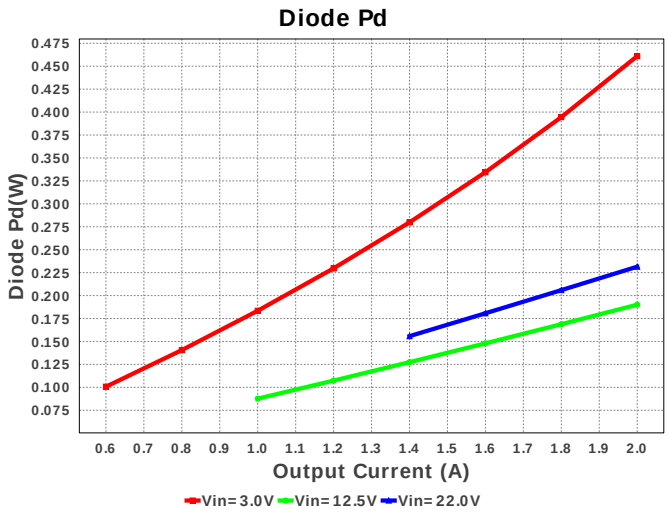
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	Ruv2	Vishay-Dale	CRCW040223K2FKED Series= CRCW..e3	Res= 23.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
28.	U1	Texas Instruments	LM25118MH/NOPB	Switcher	1	$2.40	 MXA20A 71 mm^2

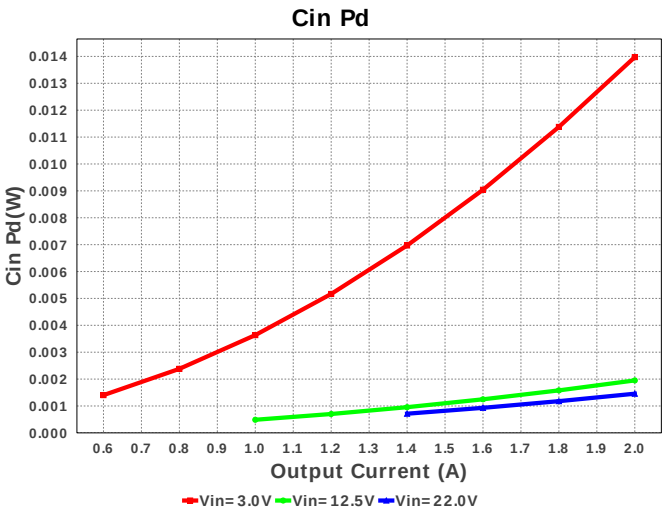


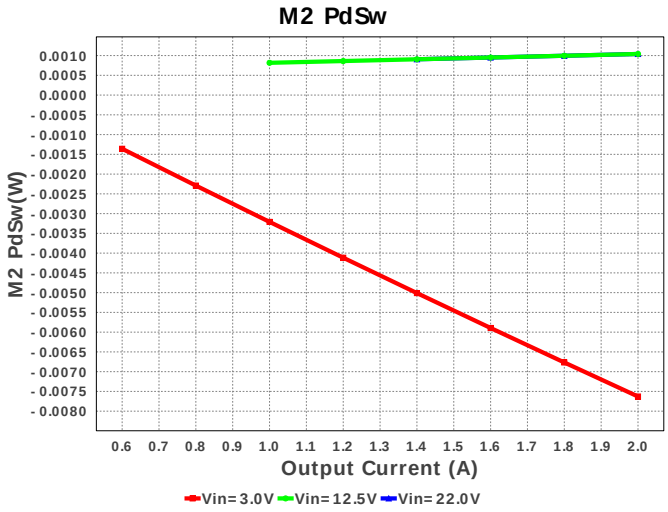


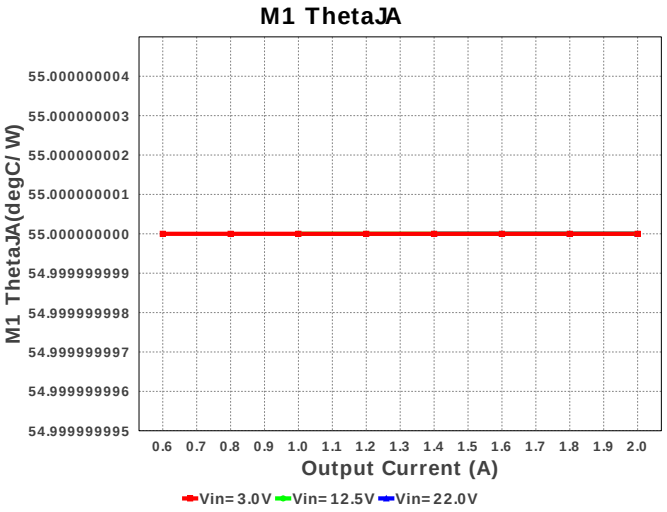


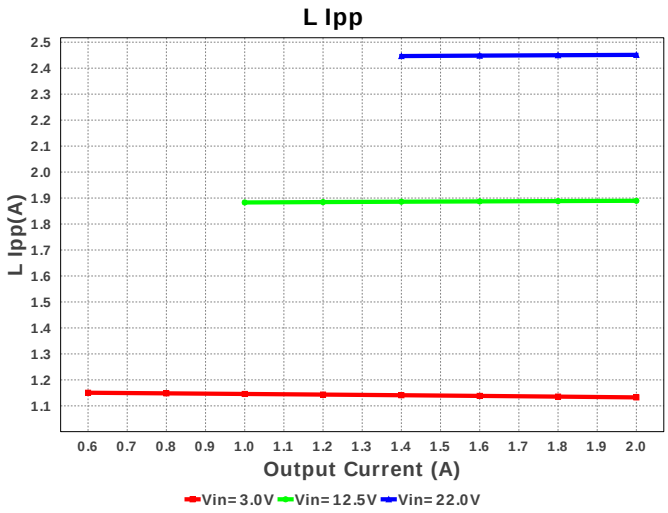


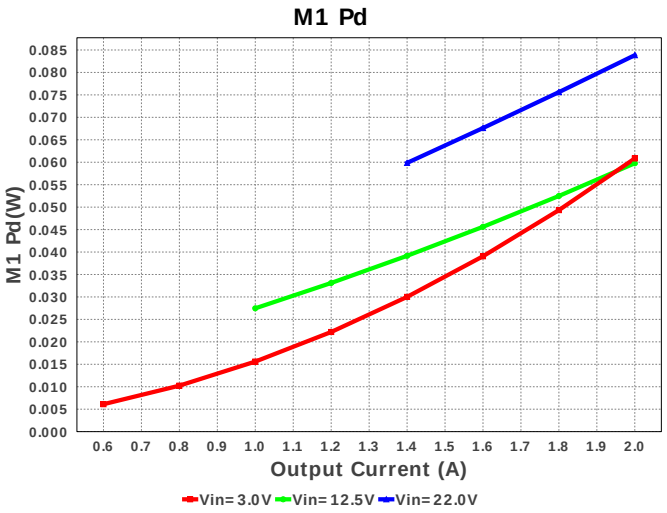


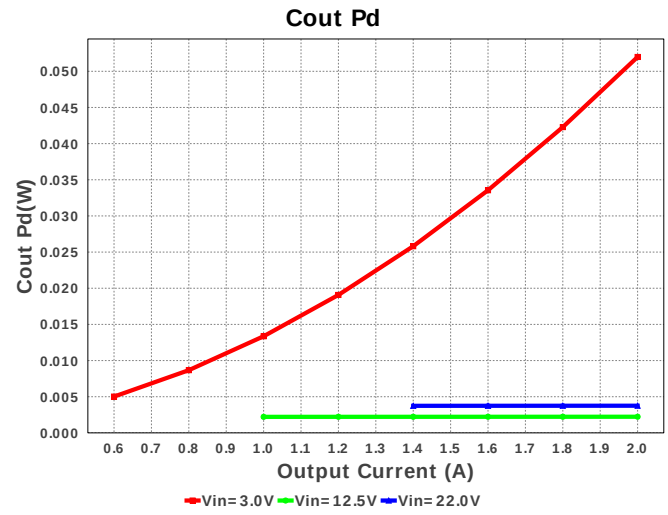


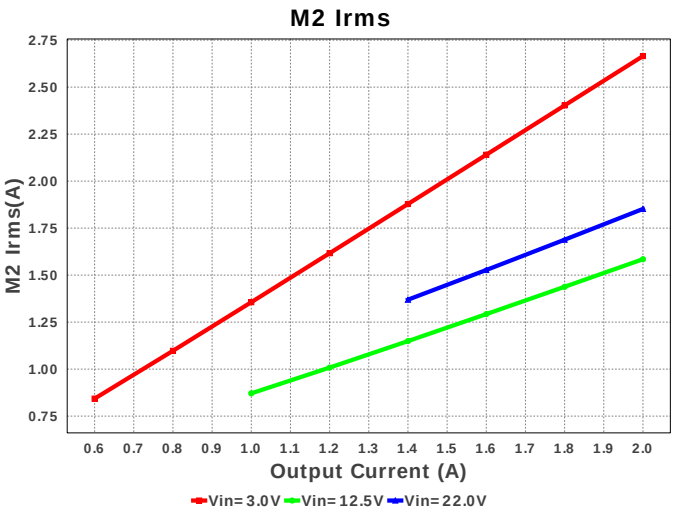


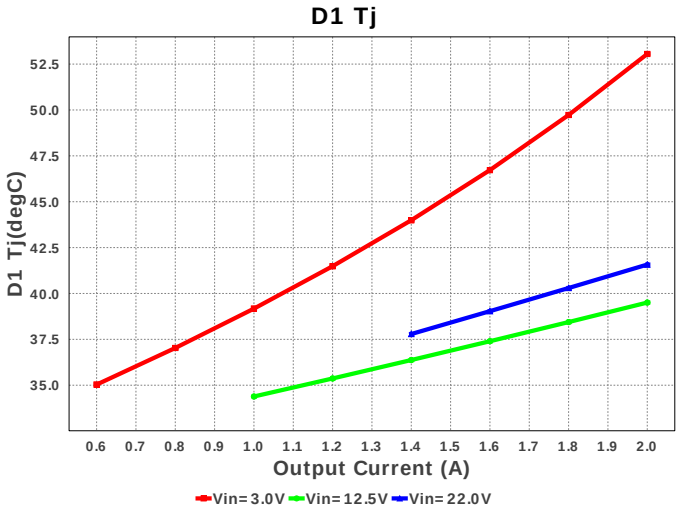


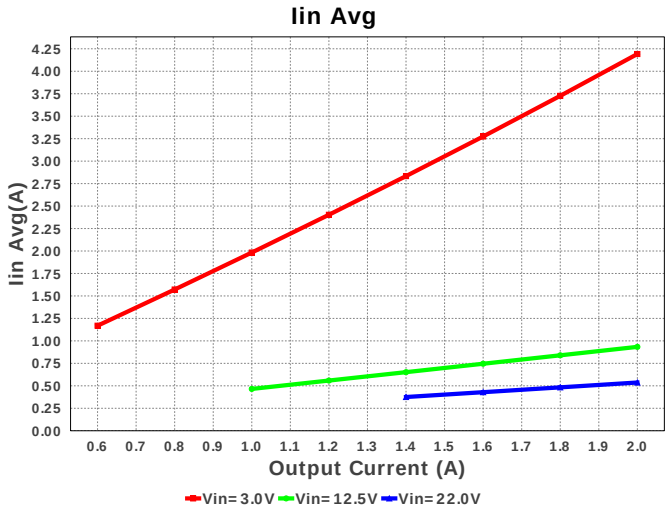


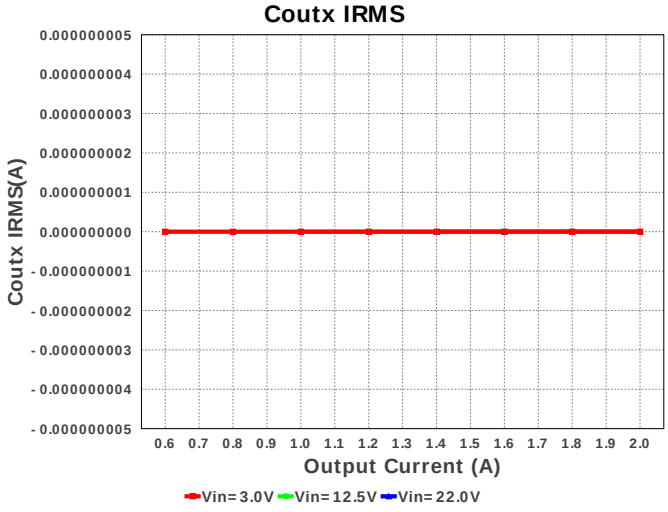


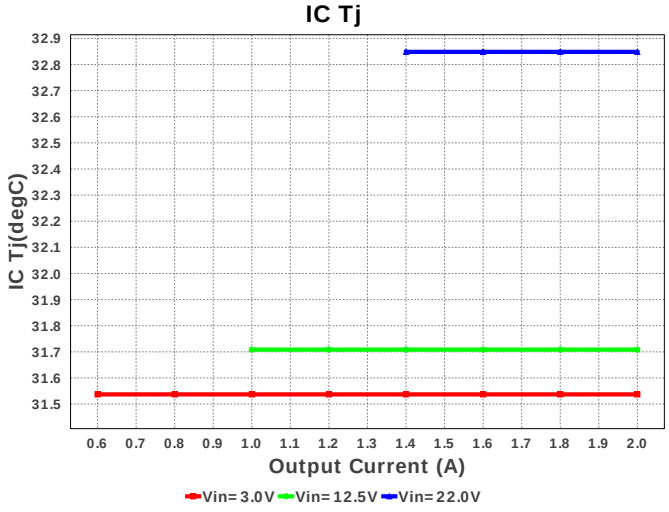


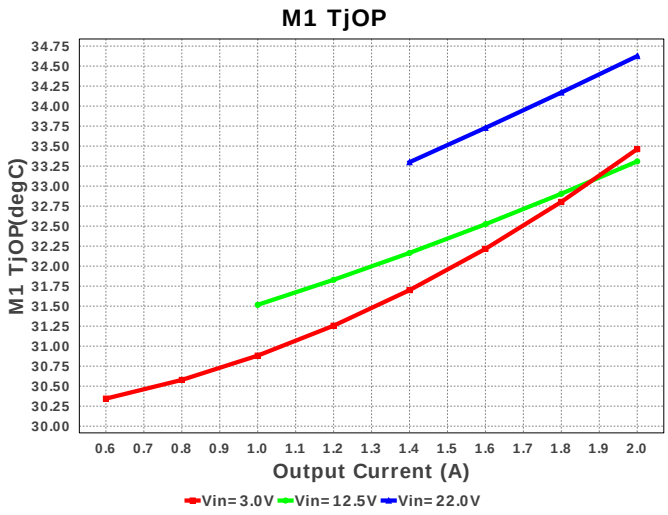


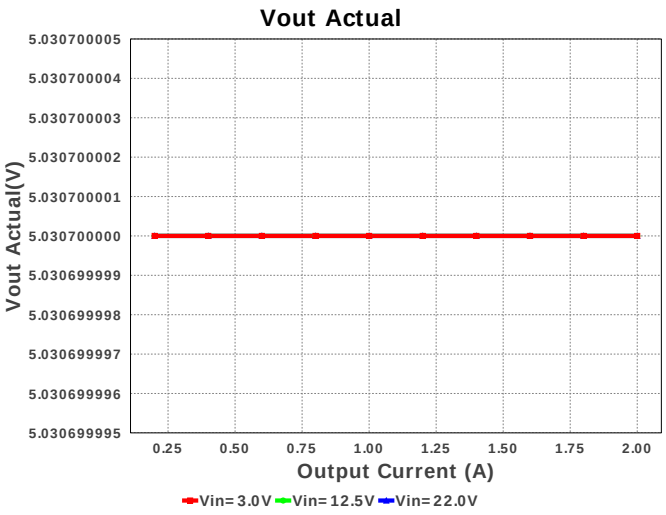


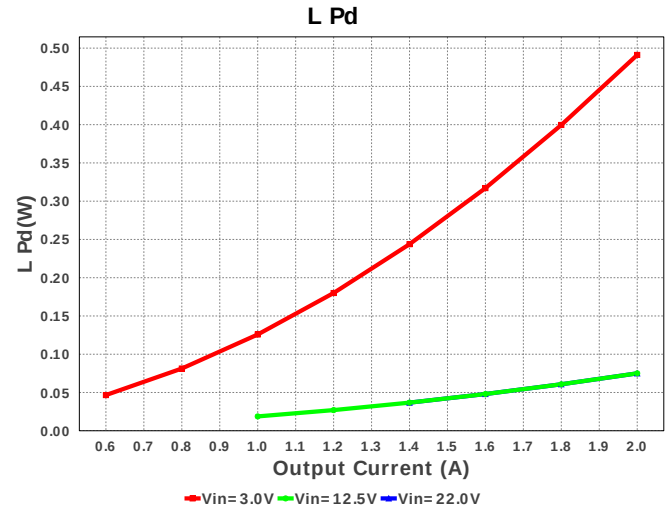


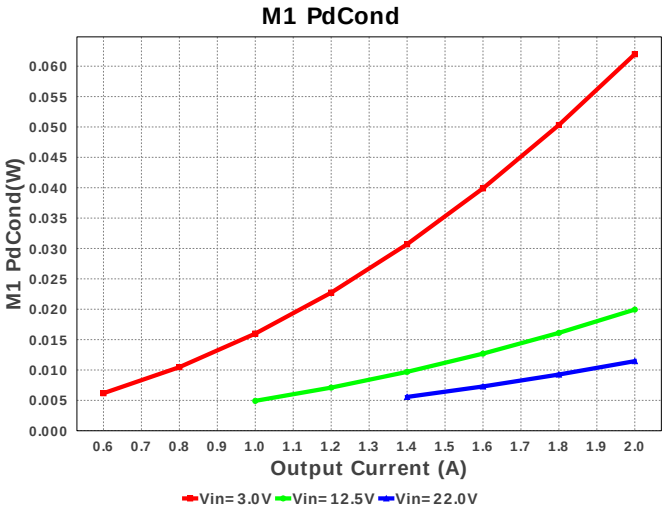


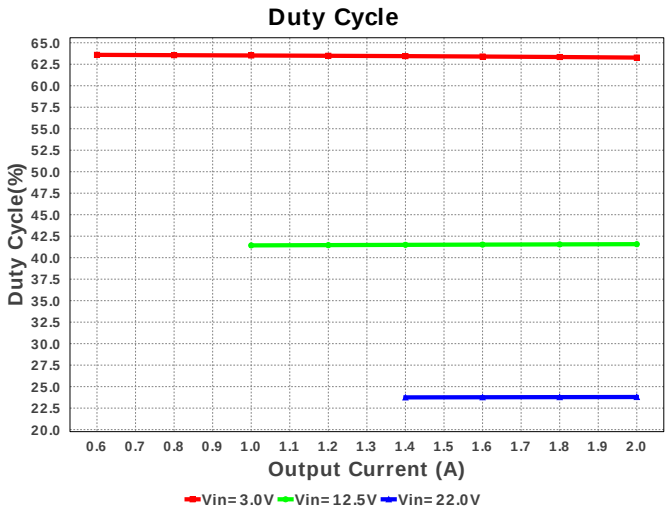


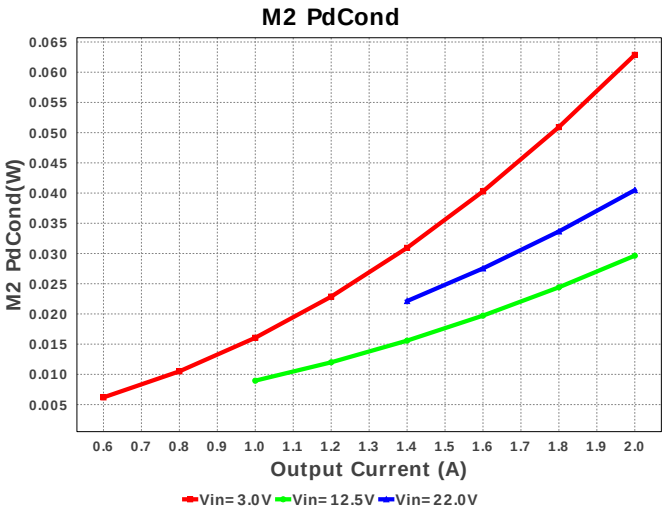


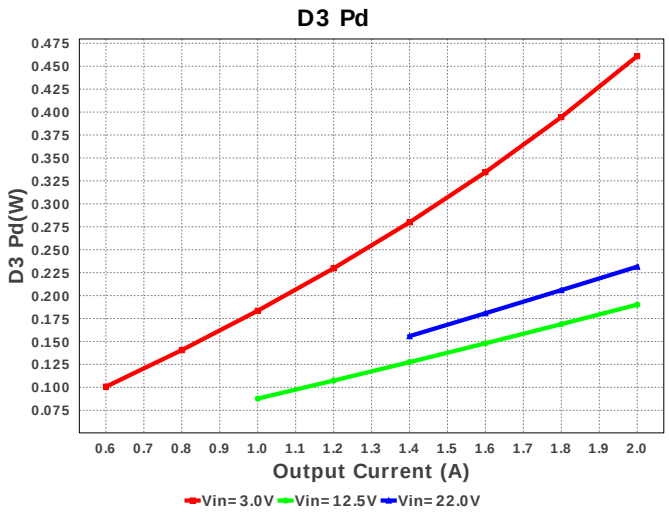


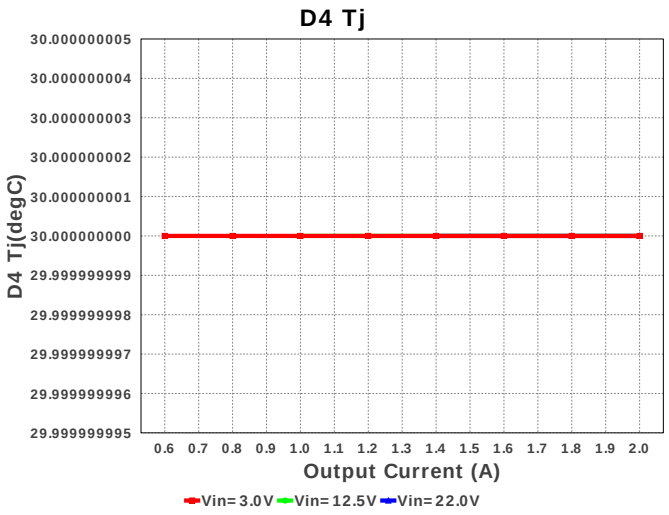


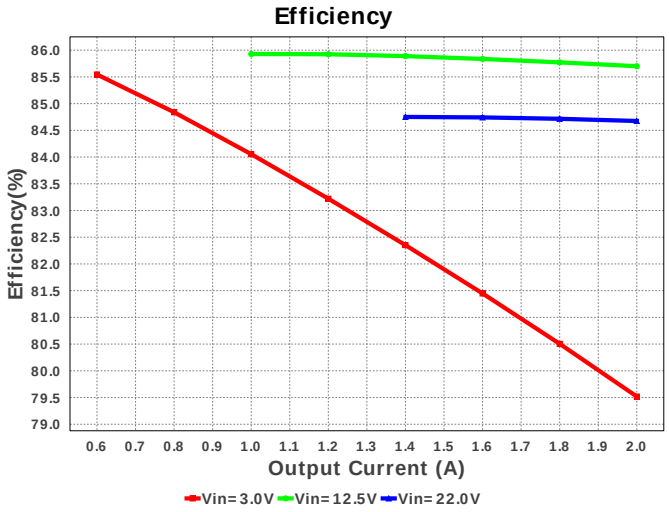


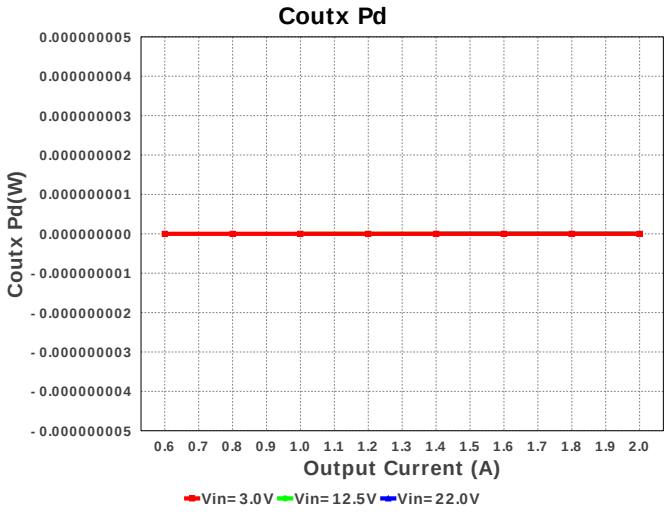


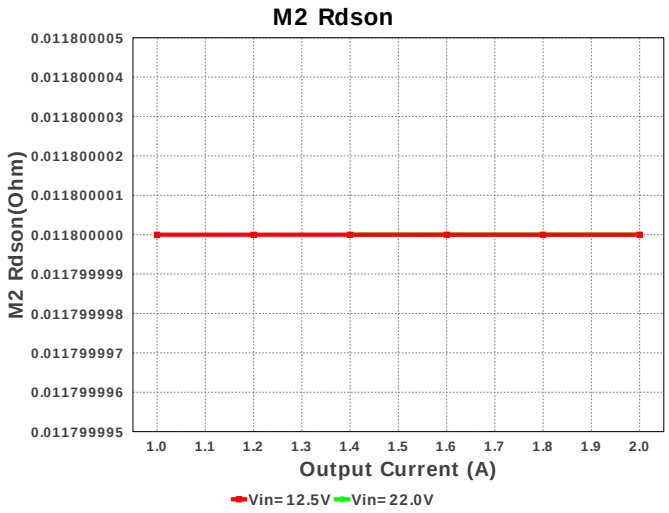


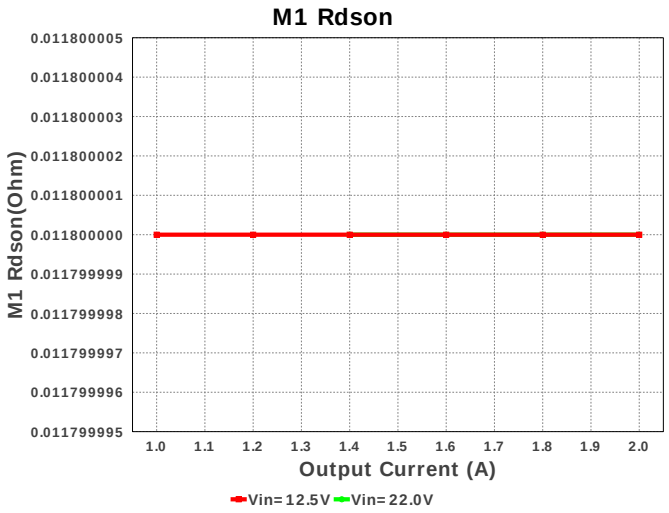


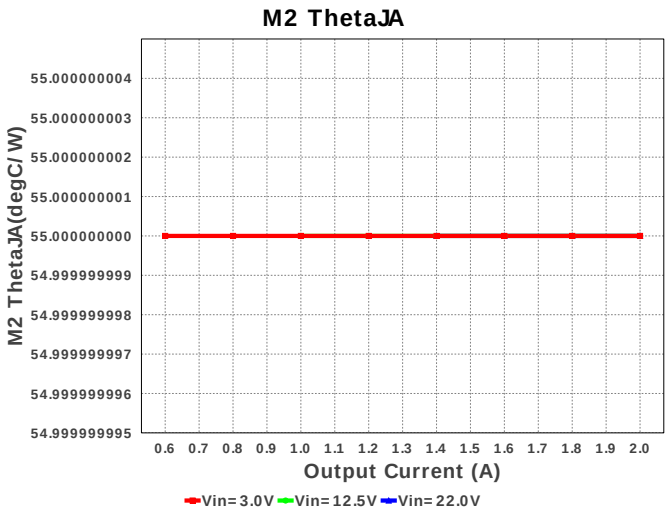


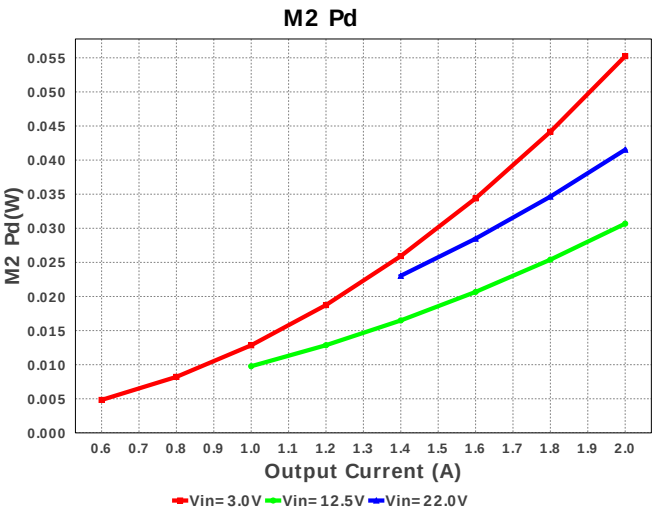


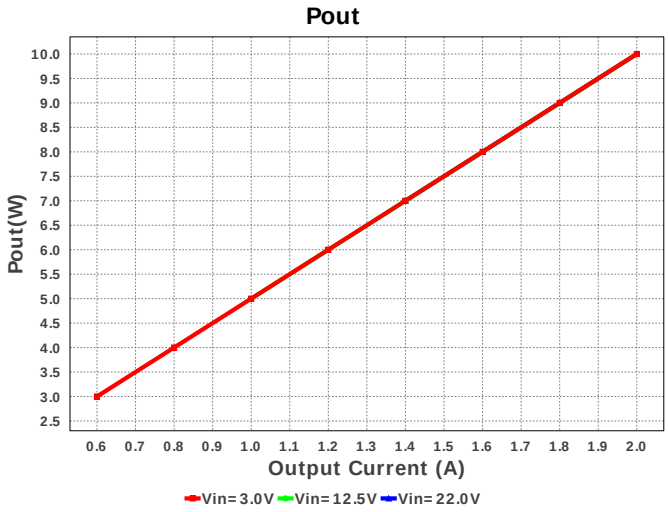


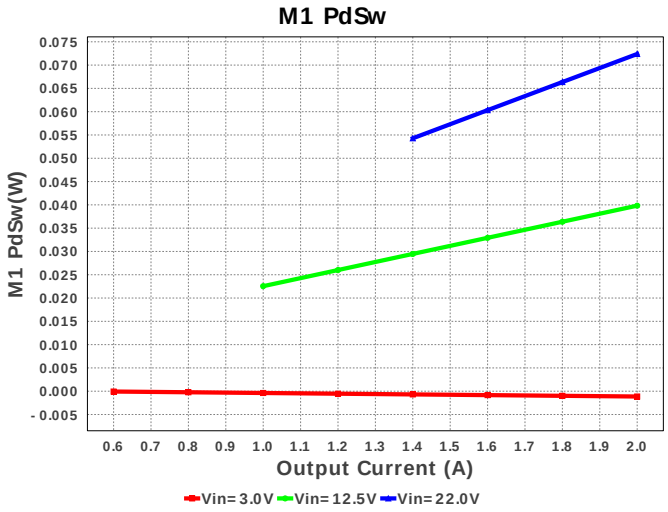


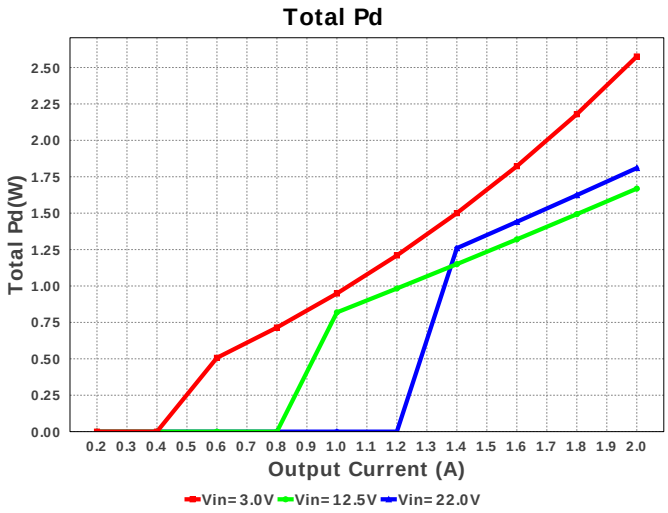


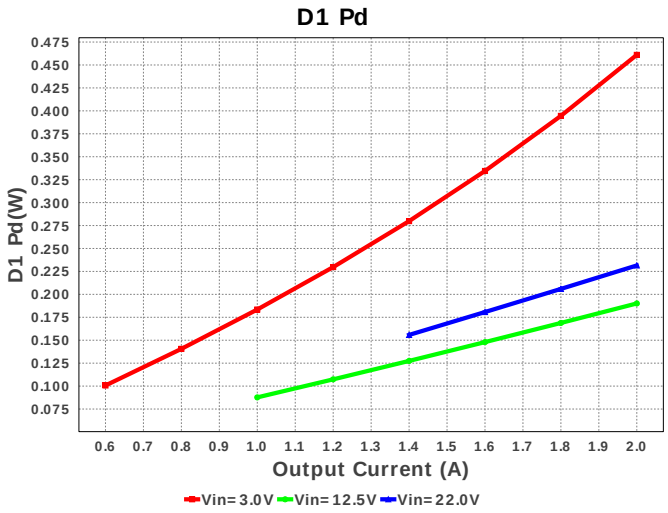


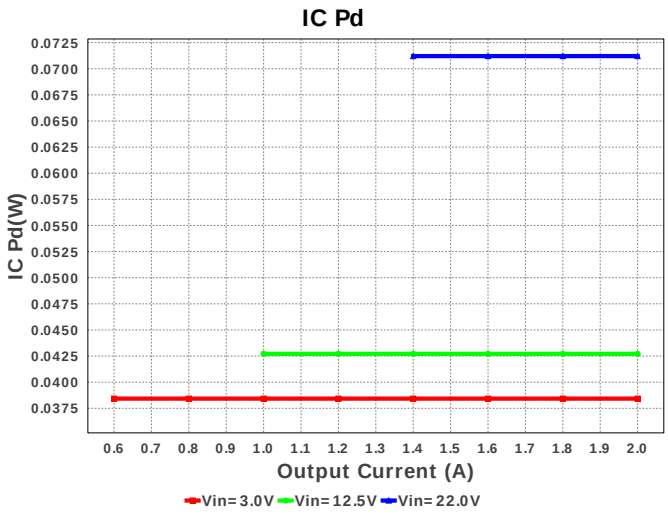


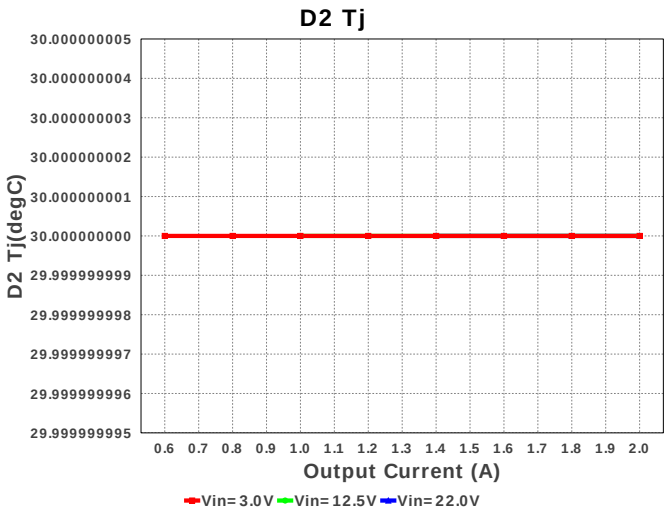


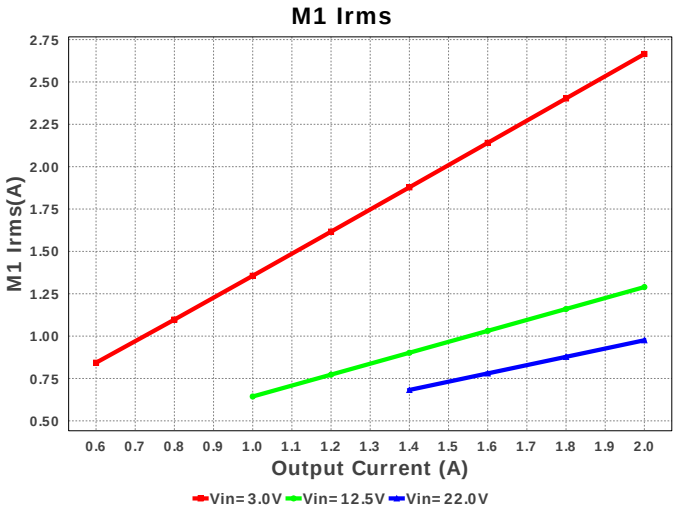


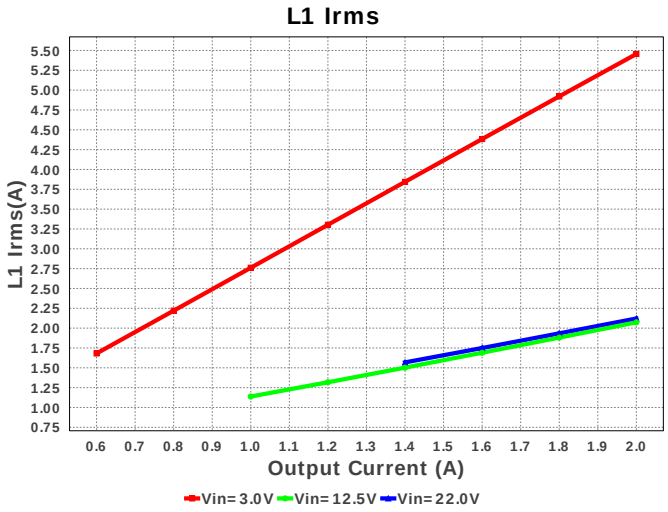


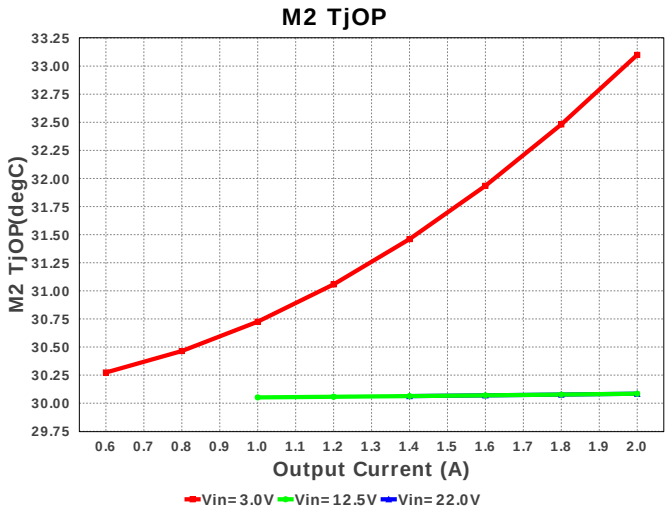


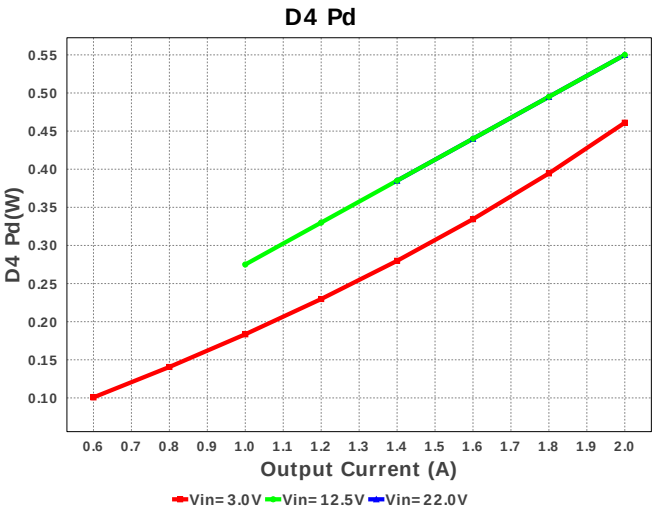


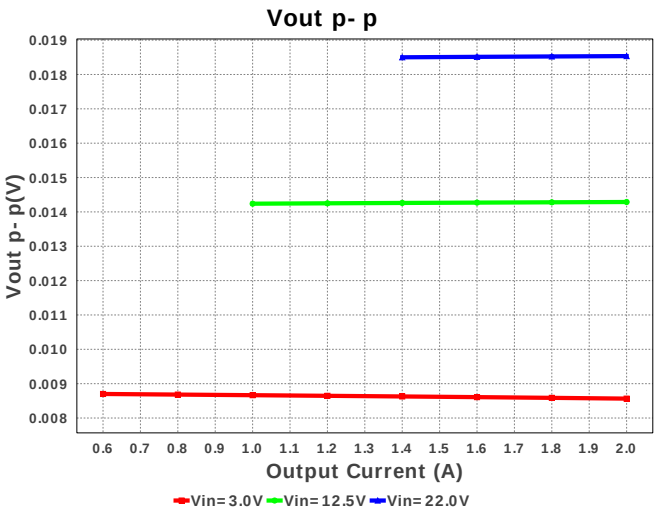


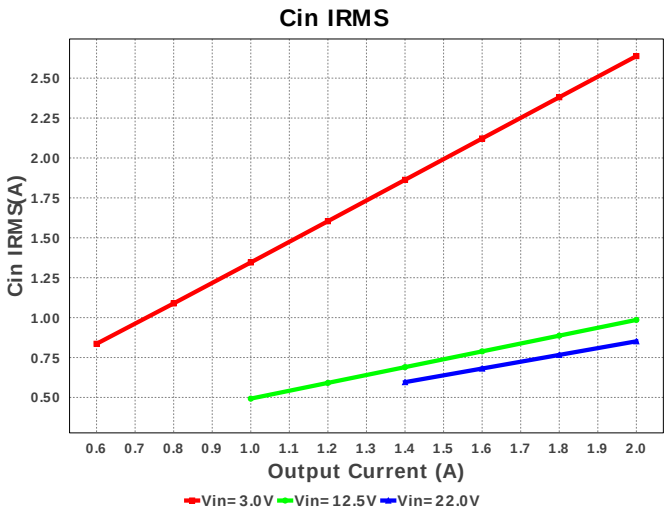


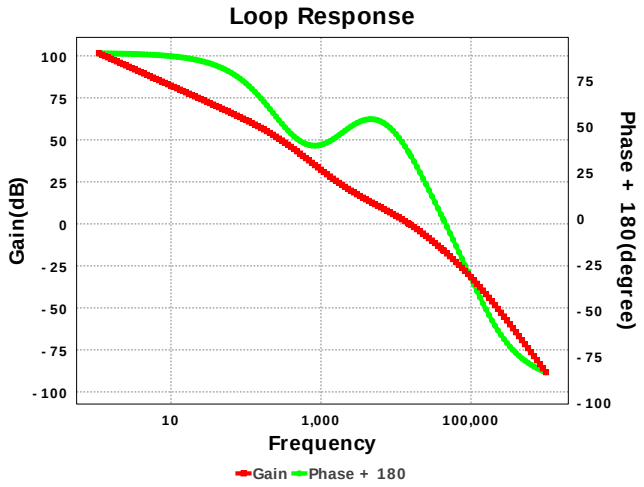












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	858.12 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	723.517 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	539.47 mA	Current	Average input current
5.	L Ipp	2.506 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	2.127 A	Current	Inductor ripple current
7.	M1 Irms	986.46 mA	Current	MOSFET RMS ripple current
8.	M2 Irms	1.85 A	Current	MOSFET RMS ripple current
9.	SW Ipk	3.253 A	Current	Peak switch current
10.	BOM Count	29	General	Total Design BOM count
11.	FootPrint	922.0 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	11.8 mOhm	General	Drain-Source On-resistance
15.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	M2 Rdson	11.8 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	$5.36	General	Total BOM Cost
20.	D1 Tj	47.443 degC	Op_Point	D1 junction temperature
21.	D1 Tj	47.443 degC	Op_Point	D1 junction temperature
22.	D2 Tj	53.051 degC	Op_Point	D2 junction temperature
23.	D3 Tj	47.443 degC	Op_Point	D3 junction temperature
24.	D4 Tj	53.051 degC	Op_Point	D4 junction temperature
25.	Low Freq Gain	101.552 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	15.048 kHz	Op_point	Bode plot crossover frequency
29.	Duty Cycle	24.328 %	Op_point	Duty cycle
30.	Efficiency	84.258 %	Op_point	Steady state efficiency
31.	Gain Marg	-15.67 dB	Op_point	Bode Plot Gain Margin

#	Name	Value	Category	Description
32.	IC Tj	32.848 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	34.643 degC	Op_point	MOSFET junction temperature
36.	M2 TjOP	46.681 degC	Op_point	MOSFET junction temperature
37.	Phase Marg	35.704 deg	Op_point	Bode Plot Phase Margin
38.	VIN_OP	22.0 V	Op_point	Vin operating point
39.	Vout p-p	18.952 mV	Op_point	Peak-to-peak output ripple voltage
40.	Cin Pd	1.479 mW	Power	Input capacitor power dissipation
41.	Cout Pd	3.926 mW	Power	Output capacitor power dissipation
42.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
43.	D1 Pd	348.867 mW	Power	Diode power dissipation
44.	D2 Pd	461.022 mW	Power	Diode2 power dissipation
45.	D3 Pd	348.867 mW	Power	Diode3 power dissipation
46.	D4 Pd	461.022 mW	Power	Diode4 power dissipation
47.	Diode Pd	348.867 mW	Power	Diode power dissipation
48.	IC Pd	71.21 mW	Power	IC power dissipation
49.	L Pd	75.0 mW	Power	Inductor power dissipation
50.	M1 Pd	85.409 mW	Power	MOSFET power dissipation
51.	M1 PdCond	12.964 mW	Power	M1 MOSFET conduction losses
52.	M1 PdSw	72.445 mW	Power	M1 MOSFET switching losses
53.	M2 Pd	53.548 mW	Power	MOSFET power dissipation
54.	M2 PdCond	43.356 mW	Power	M2 MOSFET conduction losses
55.	M2 PdSw	10.193 mW	Power	M2 MOSFET switching losses
56.	Total Pd	1.868 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	3.0	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.