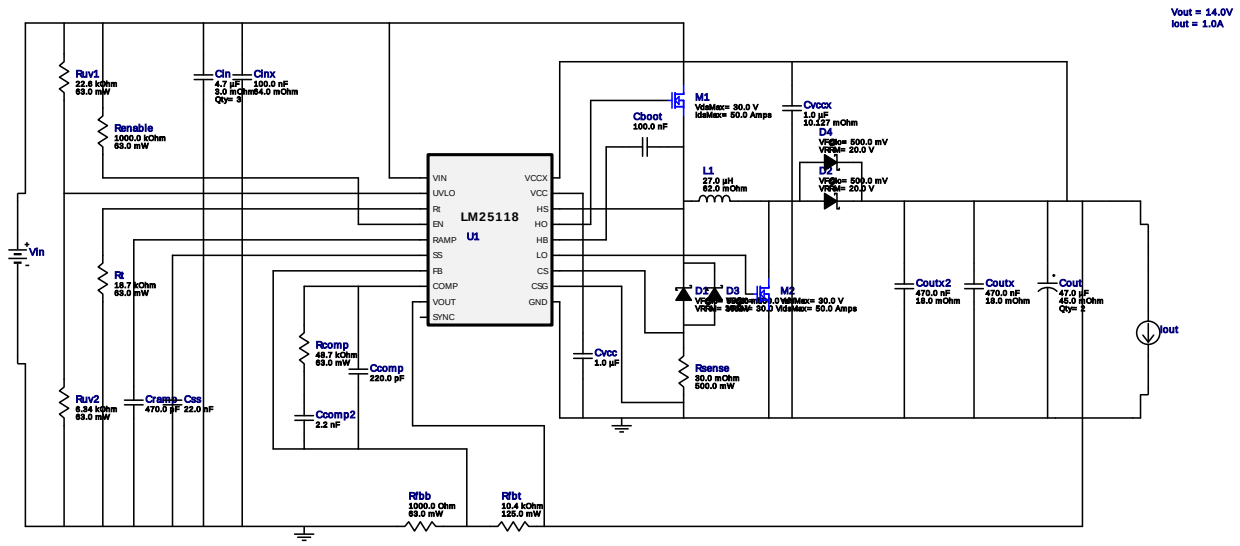
WEBENCH® Design Report

VinMin = 7.0V
VinMax = 21.0V
Vout = 14.0V
Iout = 1.0A

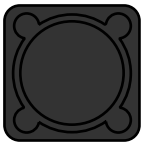
Device = LM25118MH/NOPB
Topology = Buck_Boost
Created = 9/9/16 1:55:59 AM
BOM Cost = $5.53
BOM Count = 31
Total Pd = 0.95W

Design : 1542746/886 LM25118MH/NOPB
LM25118MH/NOPB 7.0V-21.0V to 14.00V @ 1.0A

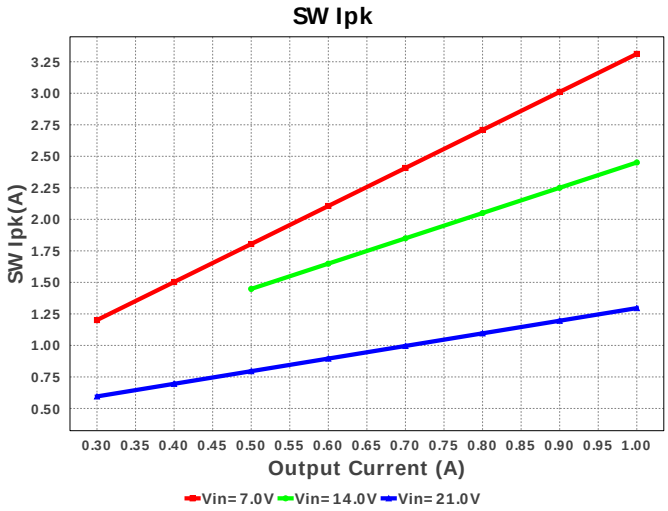


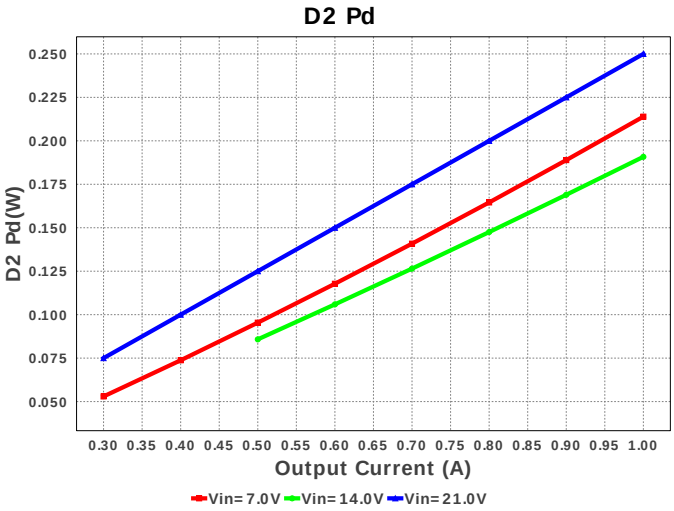
Electrical BOM

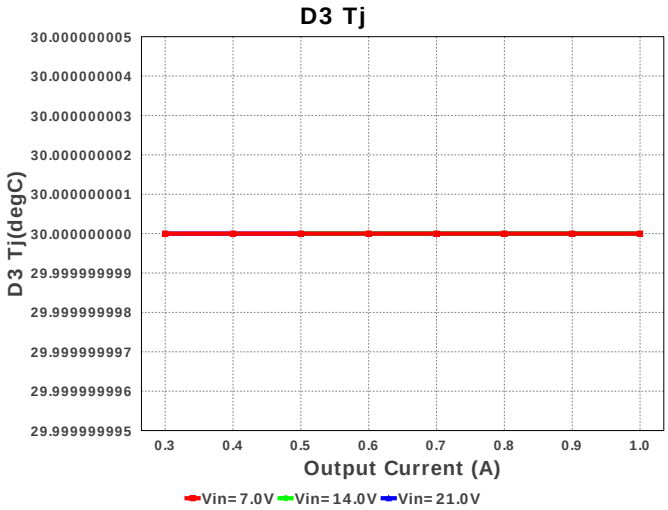
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	Yageo America	CC0805JRNPO9BN221 Series= C0G/NP0	Cap= 220.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	3	$0.07	1206 11 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	APXH200ARA470MH70G Series= PXH	Cap= 47.0 uF ESR= 45.0 mOhm VDC= 20.0 V IRMS= 2.0 A	2	$0.61	CAPSMT_62_H70 110 mm²
7.	Coutx	AVX	12063C474KAT2A Series= X7R	Cap= 470.0 nF ESR= 18.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.07	1206 11 mm²
8.	Coutx2	AVX	12063C474KAT2A Series= X7R	Cap= 470.0 nF ESR= 18.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.07	1206 11 mm²
9.	Cramp	Yageo America	CC0805KRX7R9BB471 Series= X7R	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²

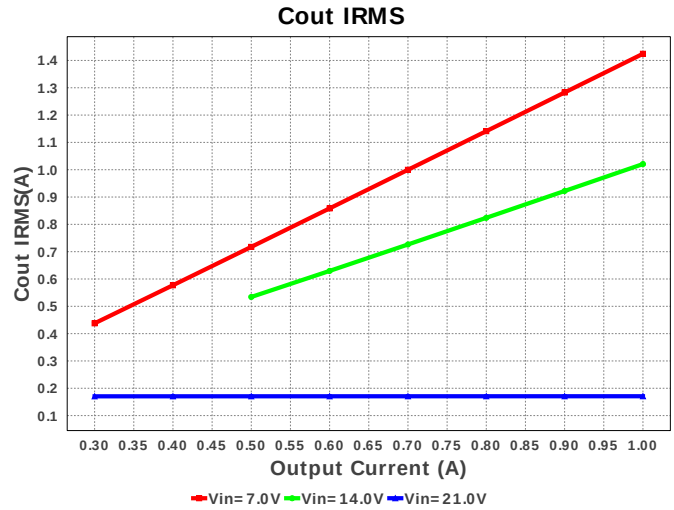
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Css	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
11.	Cvcc	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0805 7 mm²
12.	Cvccx	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	$0.01	 0603 5 mm²
13.	D1	Diodes Inc.	B230A-13-F	VF@Io= 500.0 mV VRRM= 30.0 V	1	$0.09	 SMA 37 mm²
14.	D2	Diodes Inc.	B220-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	$0.08	 SMB 44 mm²
15.	D3	Diodes Inc.	B230A-13-F	VF@Io= 500.0 mV VRRM= 30.0 V	1	$0.09	 SMA 37 mm²
16.	D4	Diodes Inc.	B220-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	$0.08	 SMB 44 mm²
17.	L1	Bourns	SRR1208-270ML	L= 27.0 µH DCR= 62.0 mOhm	1	$0.37	 SRR1208 216 mm²
18.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	$0.28	 DQG0008A 18 mm²
19.	M2	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	$0.28	 DQG0008A 18 mm²
20.	Rcomp	Vishay-Dale	CRCW040248K7FKED Series= CRCW..e3	Res= 48.7 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	Yageo America	RT0805BRD0710K4L Series= RT0805	Res= 10.4 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.04	 0805 7 mm²
24.	Rsense	Stackpole Electronics Inc	CSR1206FK30L0 Series= ?	Res= 30.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.10	 1206 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	CRCW040222K6FKED Series= CRCW..e3	Res= 22.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
27.	Ruv2	Vishay-Dale	CRCW04026K34FKED Series= CRCW..e3	Res= 6.34 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

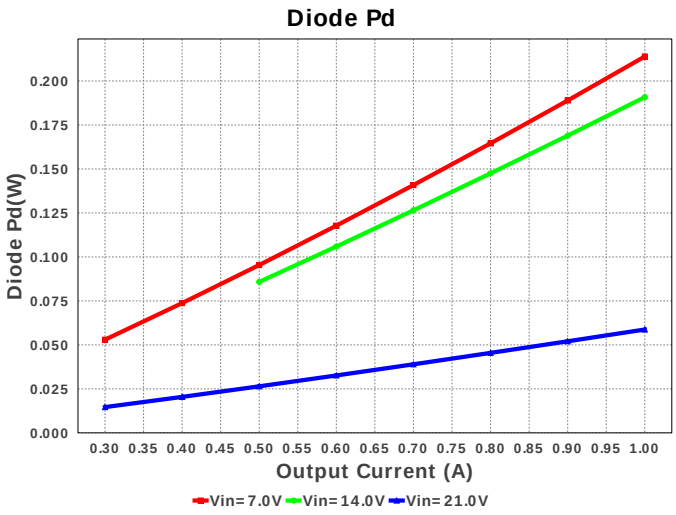
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	U1	Texas Instruments	LM25118MH/NOPB	Switcher	1	$2.40	 MXA20A 71 mm²

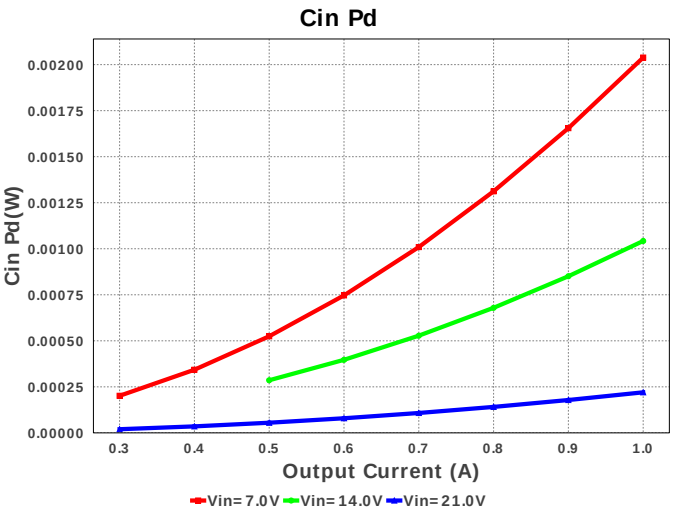


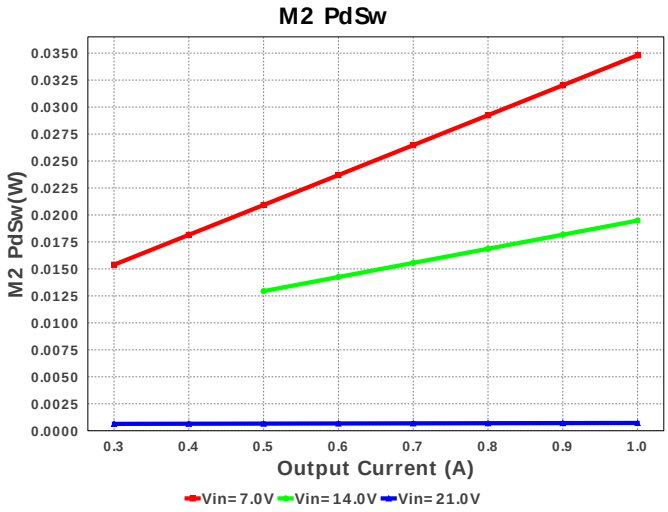


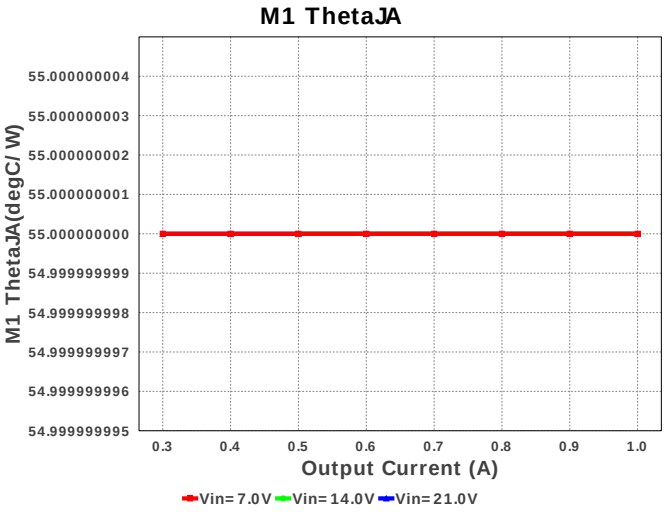


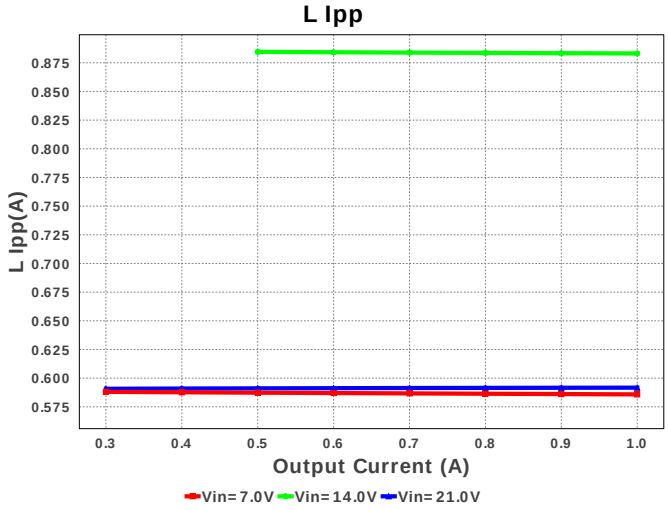


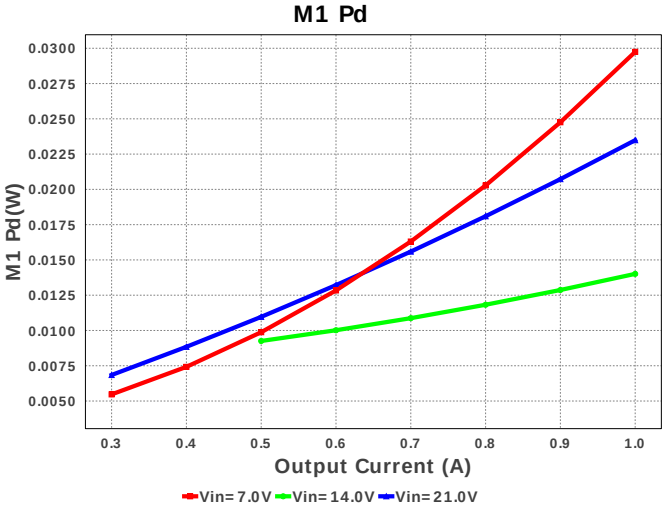


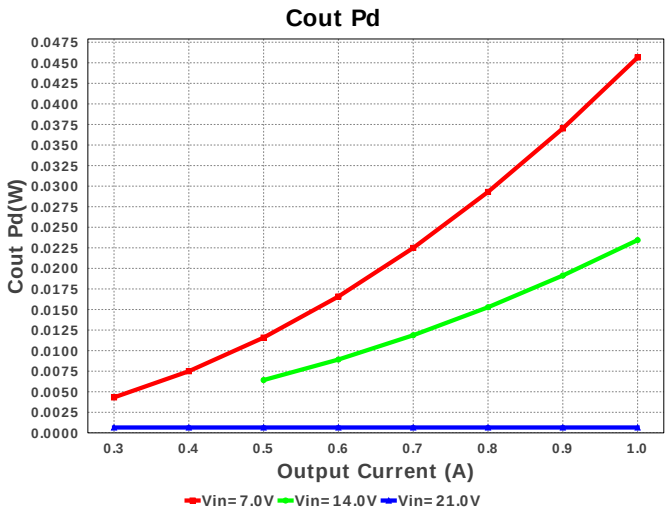


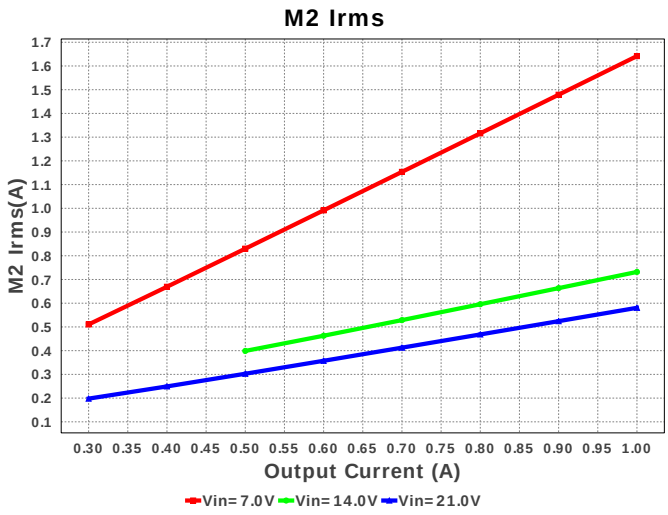


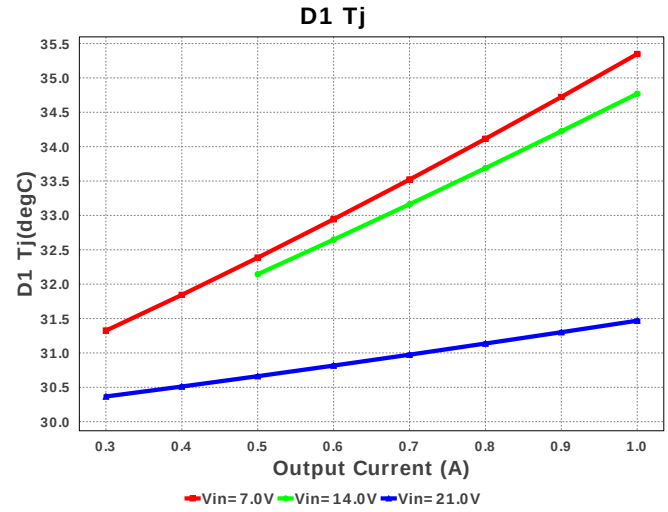


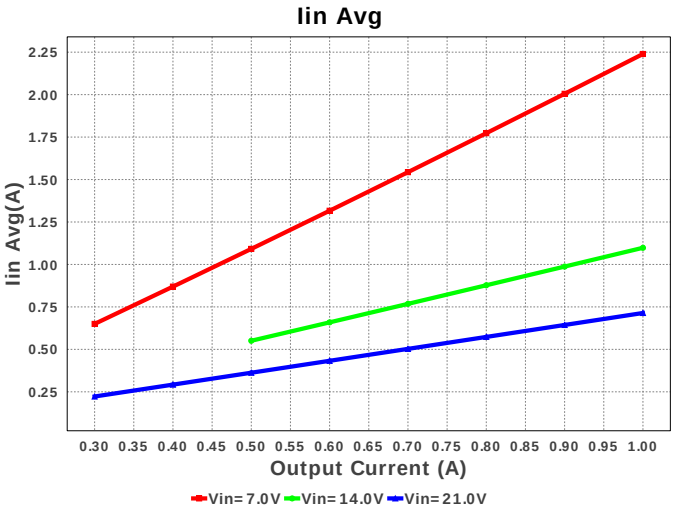


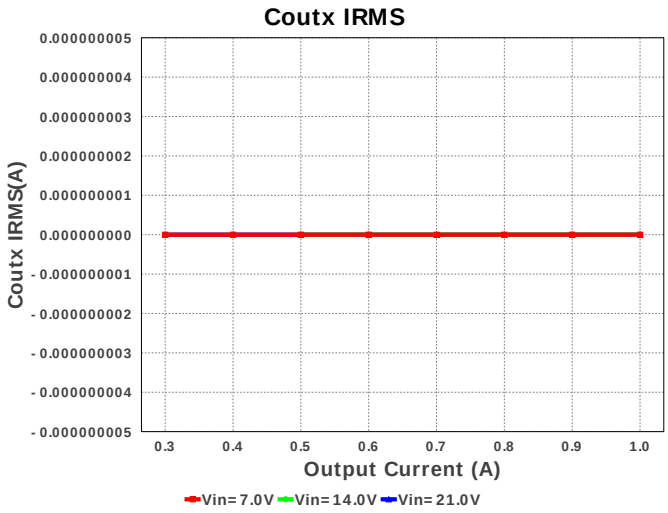


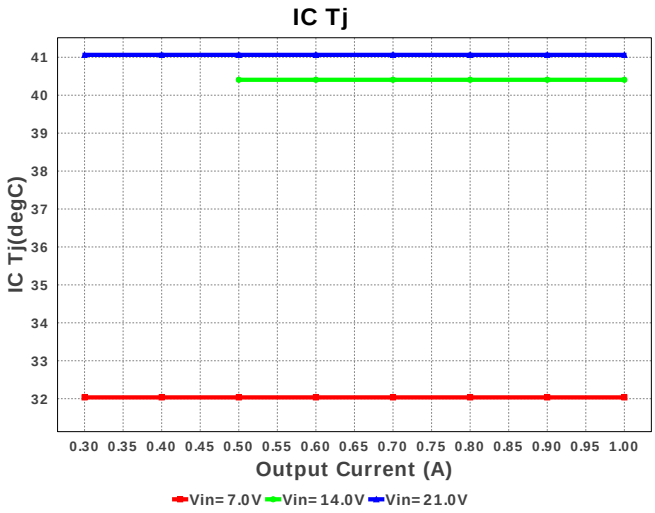


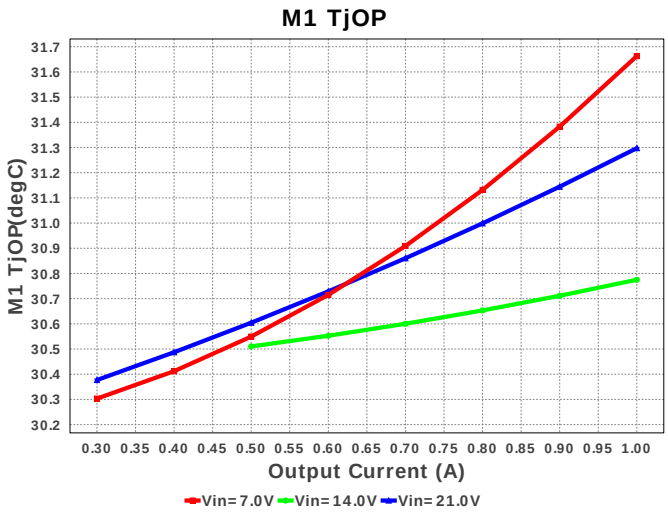


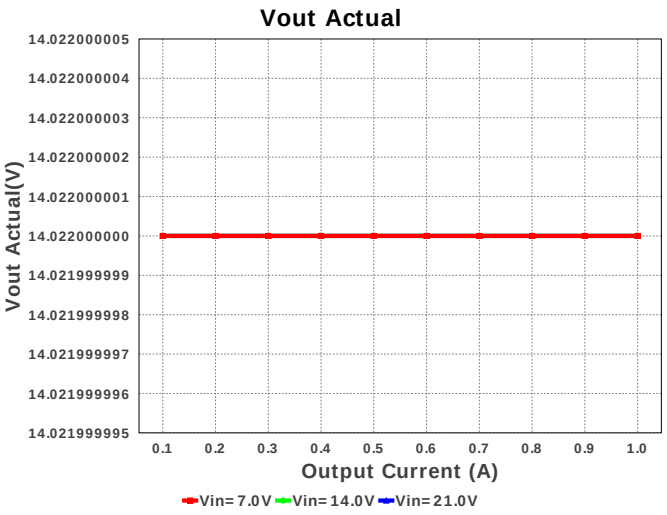


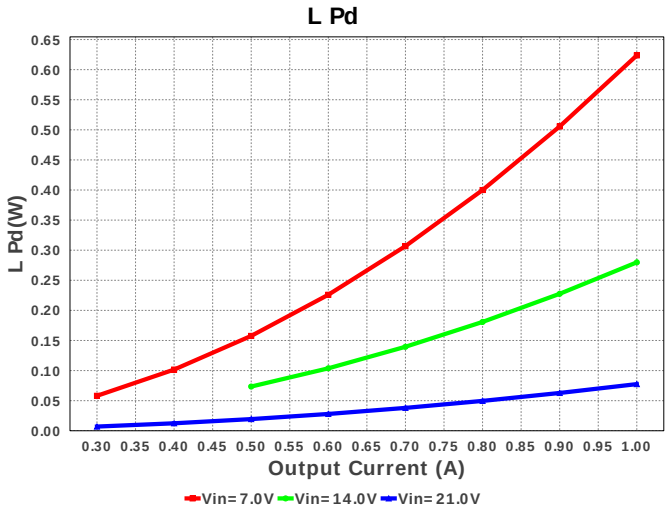


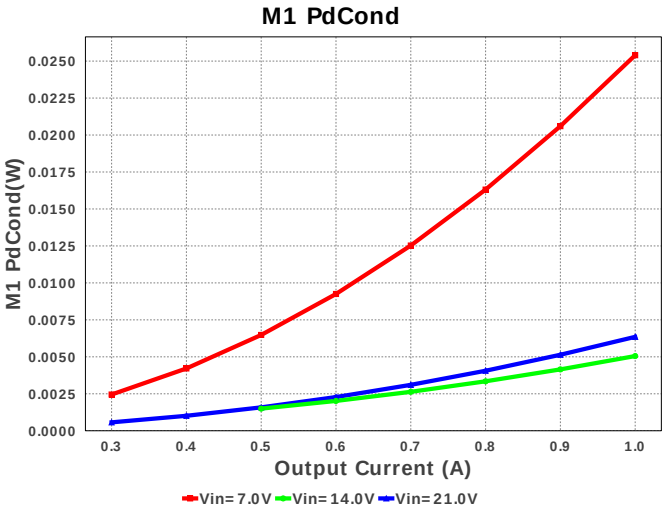


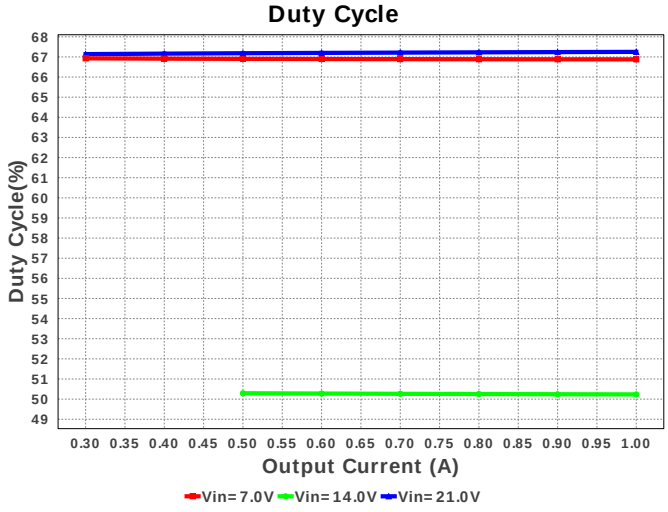


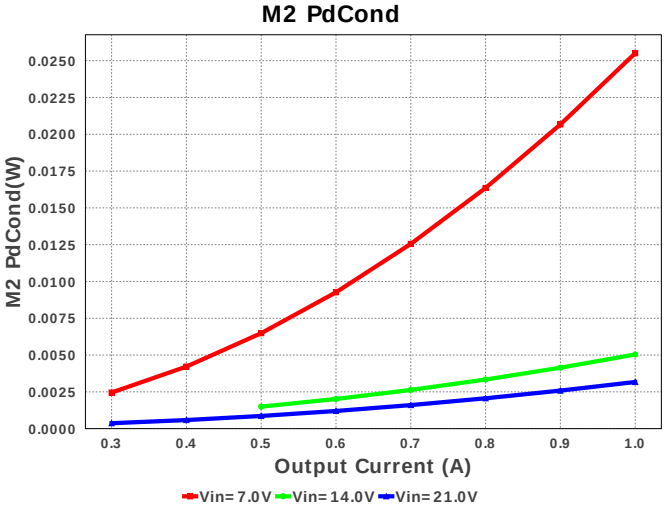


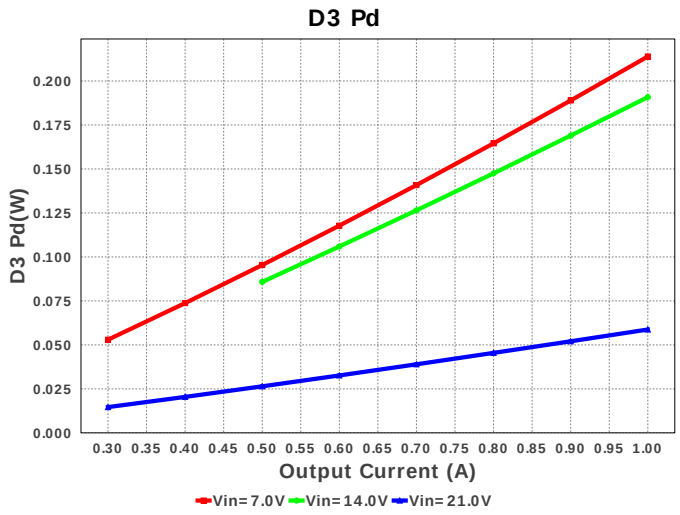


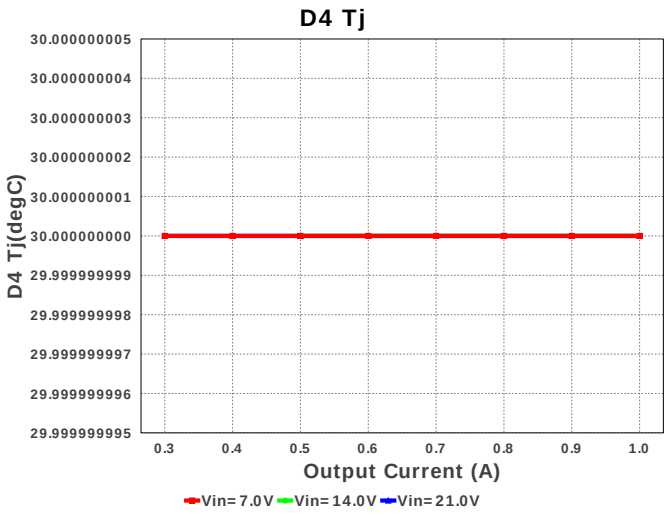


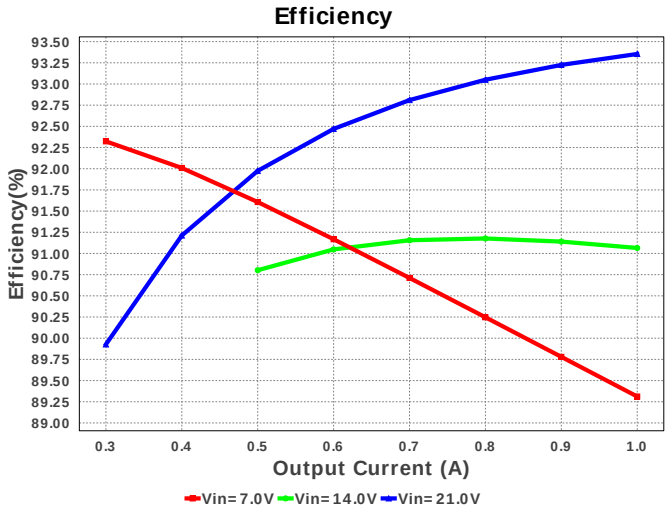


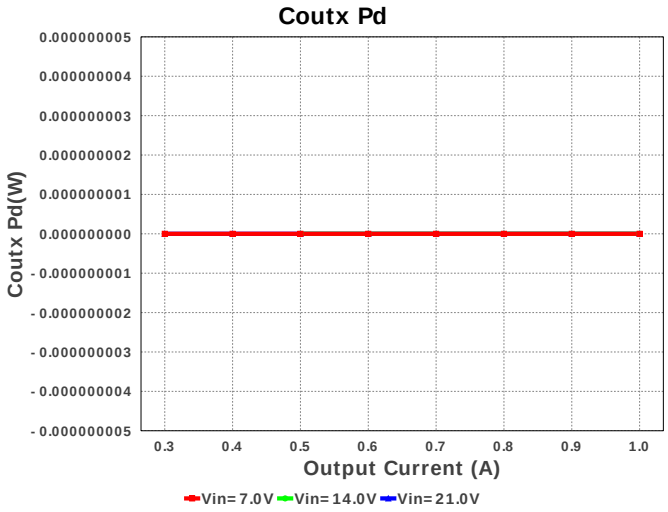


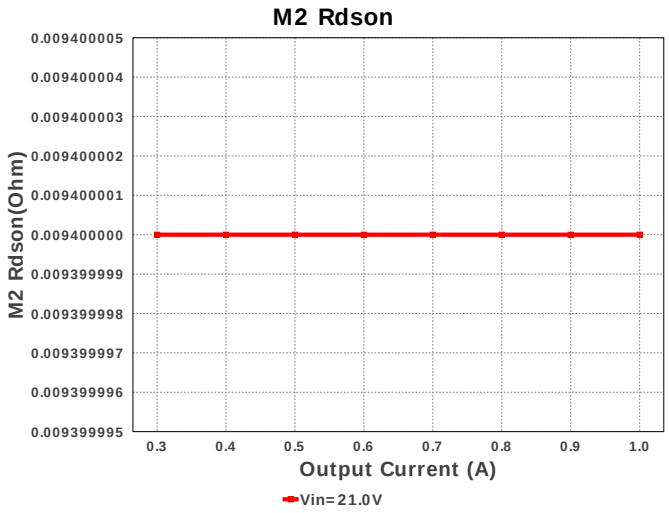


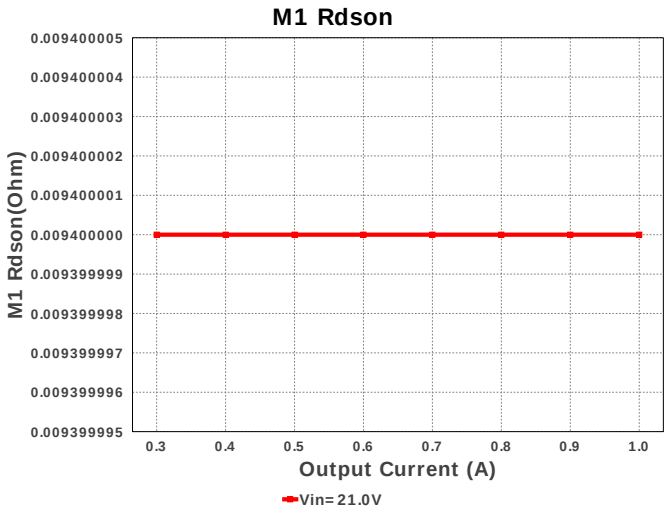


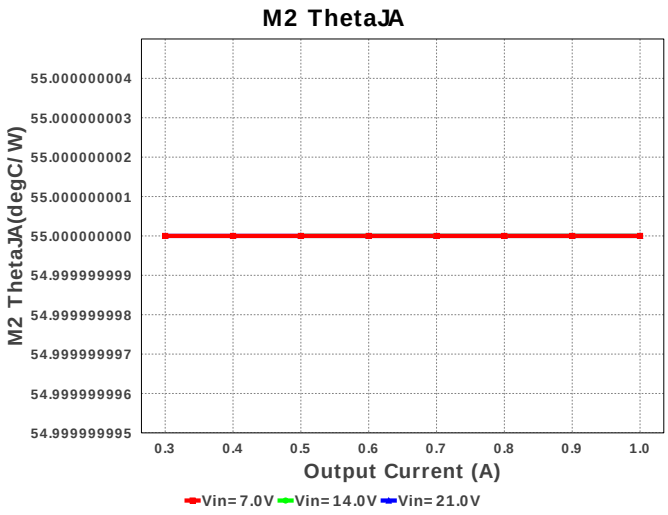


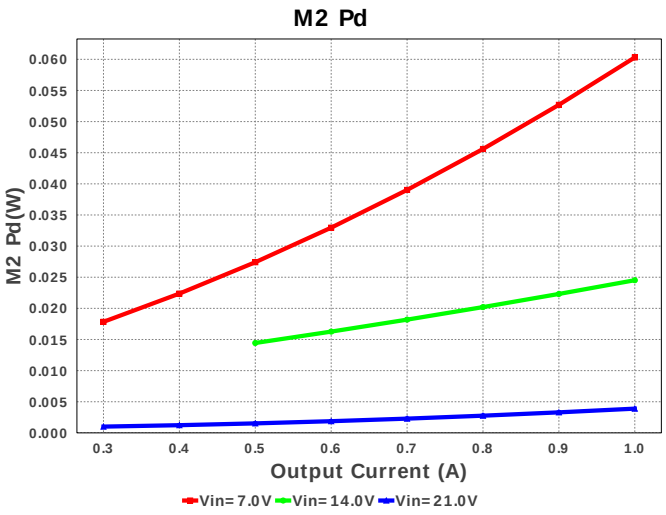


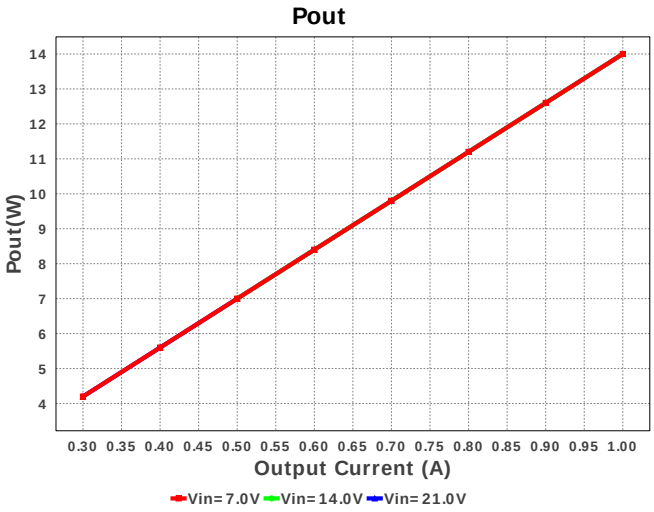


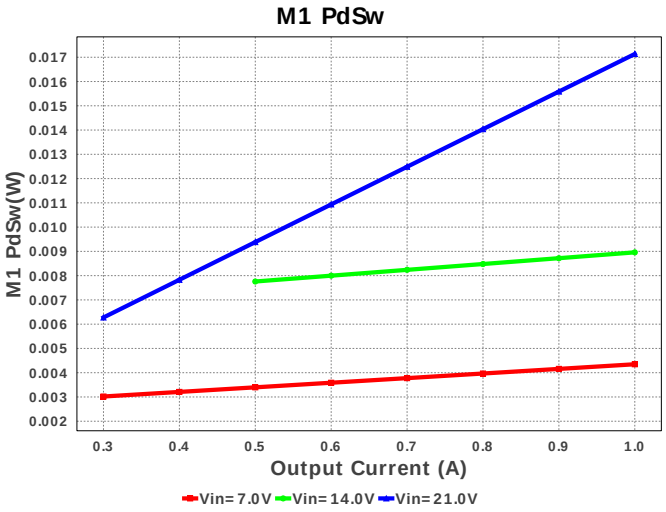


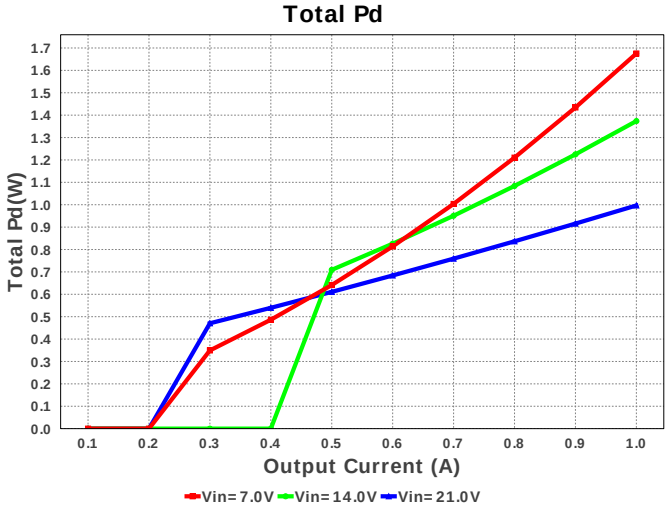


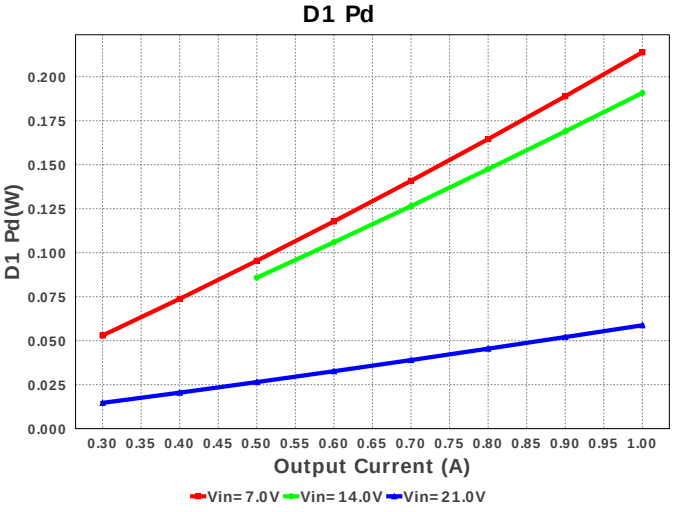


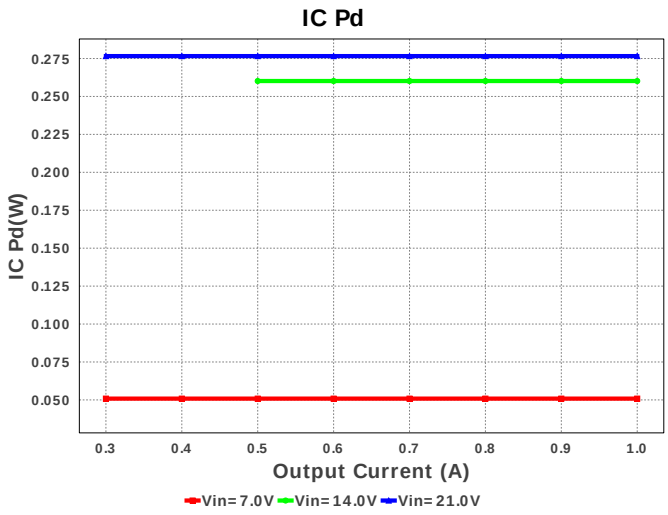


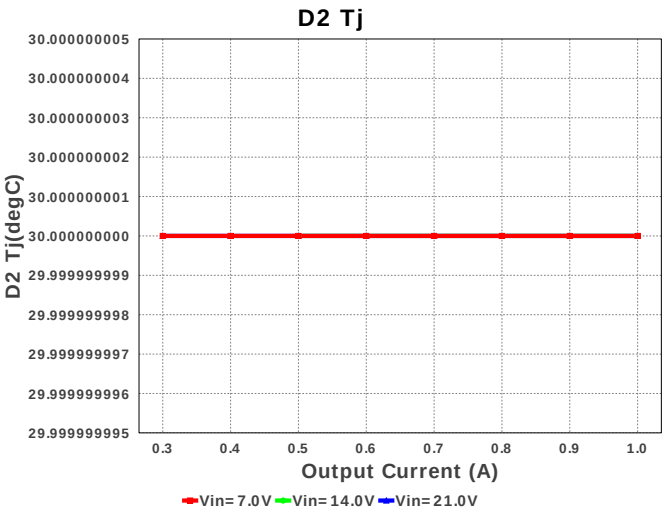


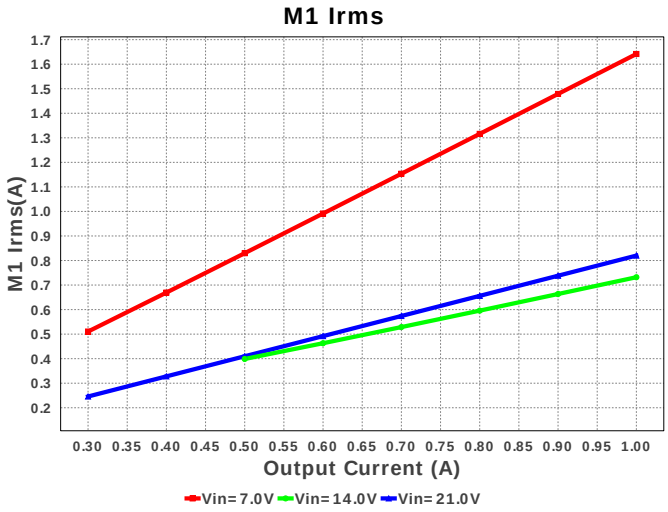


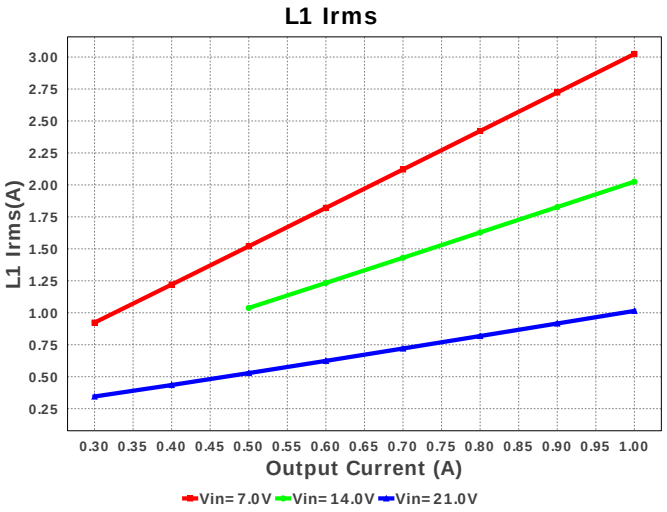


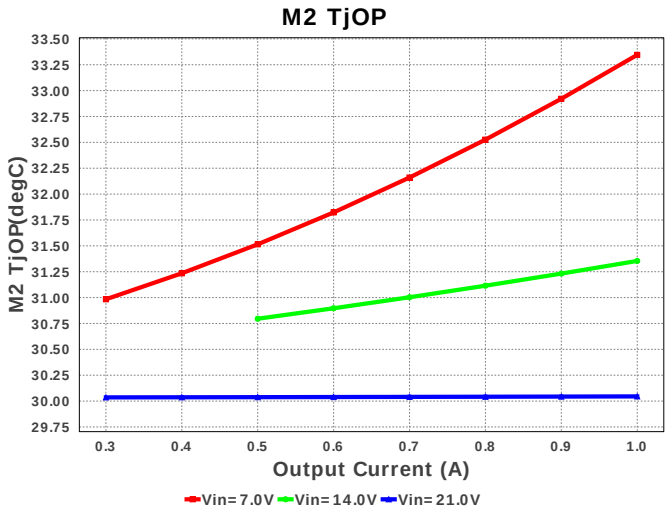


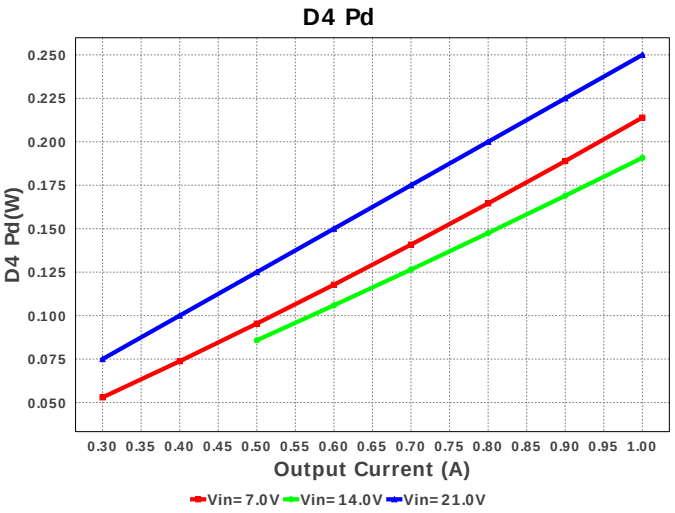


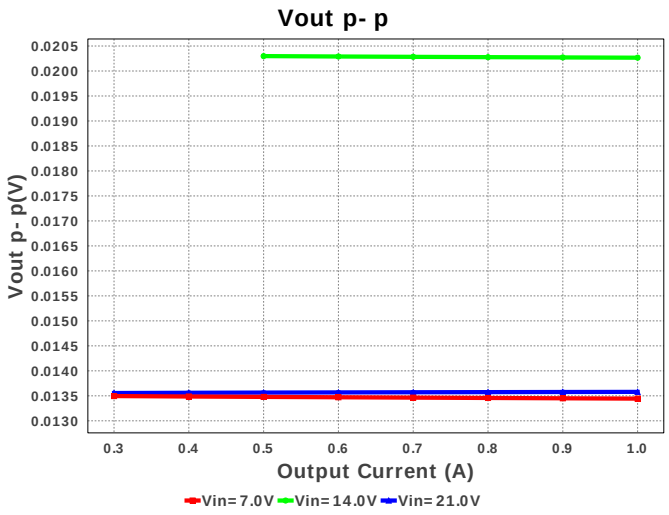


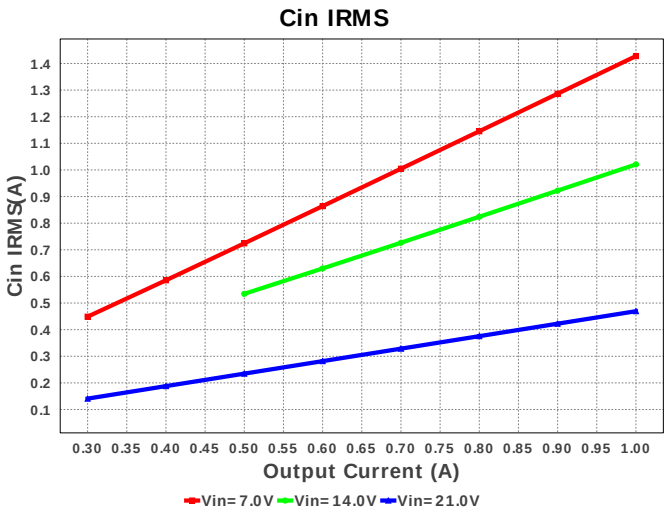


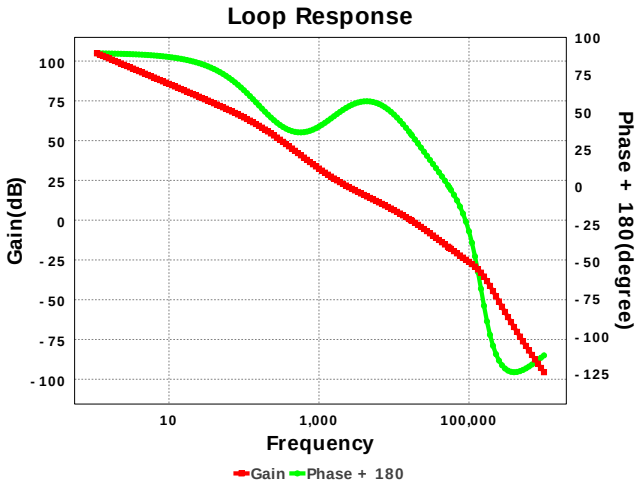












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	468.906 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	171.083 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	711.76 mA	Current	Average input current
5.	L Ipp	592.65 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	1.015 A	Current	Inductor ripple current
7.	M1 Irms	820.714 mA	Current	MOSFET RMS ripple current
8.	M2 Irms	579.641 mA	Current	MOSFET RMS ripple current
9.	SW Ipk	1.296 A	Current	Peak switch current
10.	BOM Count	31	General	Total Design BOM count
11.	FootPrint	850.0 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	9.4 mOhm	General	Drain-Source On-resistance
17.	M2 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
18.	Mode	CCM	General	Conduction Mode
19.	Pout	14.0 W	General	Total output power
20.	Total BOM	$5.53	General	Total BOM Cost
21.	D1 Tj	31.746 degC	Op_Point	D1 junction temperature
22.	D1 Tj	31.746 degC	Op_Point	D1 junction temperature
23.	D2 Tj	35.348 degC	Op_Point	D2 junction temperature
24.	D3 Tj	31.746 degC	Op_Point	D3 junction temperature
25.	D4 Tj	35.348 degC	Op_Point	D4 junction temperature
26.	Low Freq Gain	104.888 dB	Op_Point	Gain at 10Hz
27.	Vout Actual	14.022 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
28.	Vout OP	14.0 V	Op_Point	Operational Output Voltage
29.	Cross Freq	16.824 kHz	Op_point	Bode plot crossover frequency
30.	Duty Cycle	67.357 %	Op_point	Duty cycle
31.	Efficiency	93.665 %	Op_point	Steady state efficiency

#	Name	Value	Category	Description
32.	Gain Marg	-17.388 dB	Op_point	Bode Plot Gain Margin
33.	IC Tj	41.064 degC	Op_point	IC junction temperature
34.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
35.	IOUT_OP	1.0 A	Op_point	Iout operating point
36.	M1 TjOP	31.298 degC	Op_point	MOSFET junction temperature
37.	M2 TjOP	34.549 degC	Op_point	MOSFET junction temperature
38.	Operating Topology	Buck	Op_point	The current operating topology of the device
39.	Phase Marg	35.665 deg	Op_point	Bode Plot Phase Margin
40.	VIN_OP	21.0 V	Op_point	Vin operating point
41.	Vout p-p	13.6 mV	Op_point	Peak-to-peak output ripple voltage
42.	Cin Pd	219.873 µW	Power	Input capacitor power dissipation
43.	Cout Pd	658.561 µW	Power	Output capacitor power dissipation
44.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
45.	D1 Pd	69.827 mW	Power	Diode power dissipation
46.	D2 Pd	213.912 mW	Power	Diode2 power dissipation
47.	D3 Pd	69.827 mW	Power	Diode3 power dissipation
48.	D4 Pd	213.912 mW	Power	Diode4 power dissipation
49.	Diode Pd	69.827 mW	Power	Diode power dissipation
50.	IC Pd	276.591 mW	Power	IC power dissipation
51.	L Pd	77.5 mW	Power	Inductor power dissipation
52.	M1 Pd	23.645 mW	Power	MOSFET power dissipation
53.	M1 PdCond	6.498 mW	Power	M1 MOSFET conduction losses
54.	M1 PdSw	17.146 mW	Power	M1 MOSFET switching losses
55.	M2 Pd	6.784 mW	Power	MOSFET power dissipation
56.	M2 PdCond	3.205 mW	Power	M2 MOSFET conduction losses
57.	M2 PdSw	3.578 mW	Power	M2 MOSFET switching losses
58.	Total Pd	946.89 mW	Power	Total Power Dissipation
59.	Vout Tolerance	2.492 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	VinMax	21.0	Maximum input voltage
3.	VinMin	7.0	Minimum input voltage
4.	Vout	14.0	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.