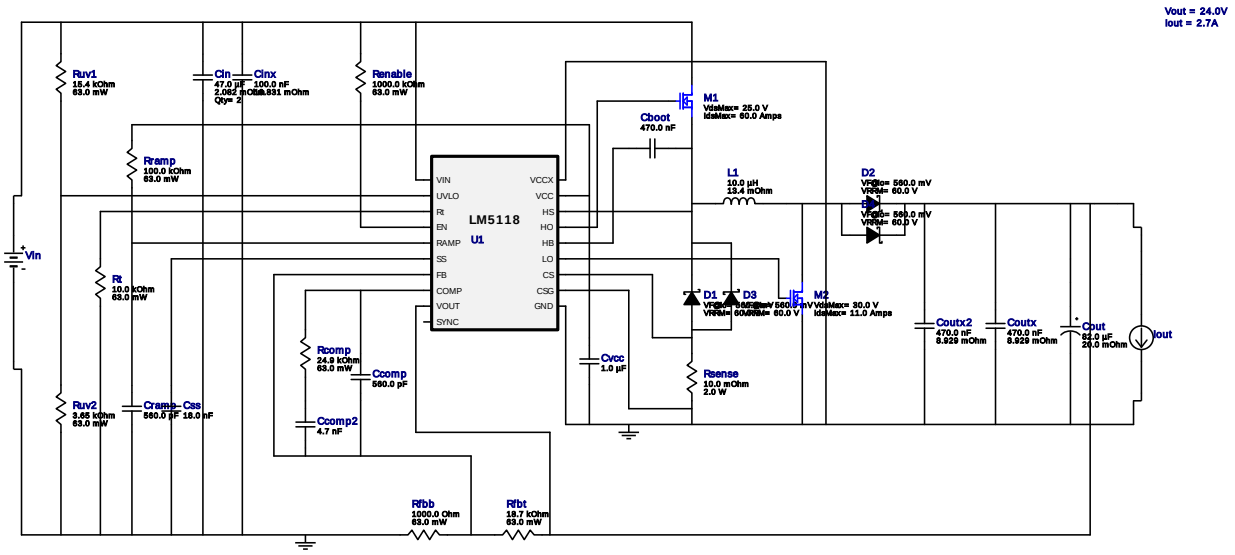
WEBENCH® Design Report

VinMin = 8.0V
VinMax = 14.0V
Vout = 24.0V
Iout = 2.7A

Device = LM5118MH/NOPB
Topology = Buck_Boost
Created = 6/21/16 10:22:27 AM
BOM Cost = $9.41
BOM Count = 29
Total Pd = 4.09W

Design : 4602135/64 LM5118MH/NOPB
LM5118MH/NOPB 8.0V-14.0V to 24.00V @ 2.7A



My Comments

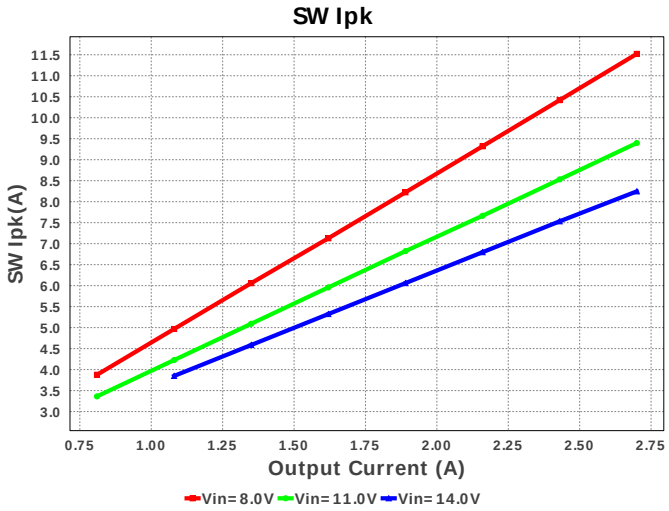
No comments

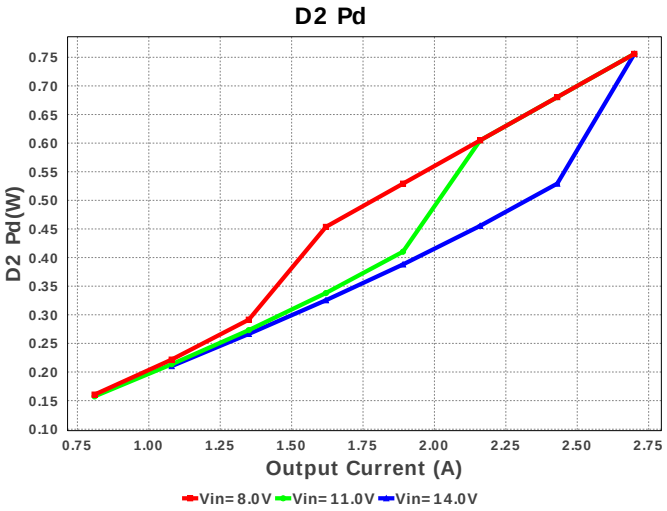
Electrical BOM

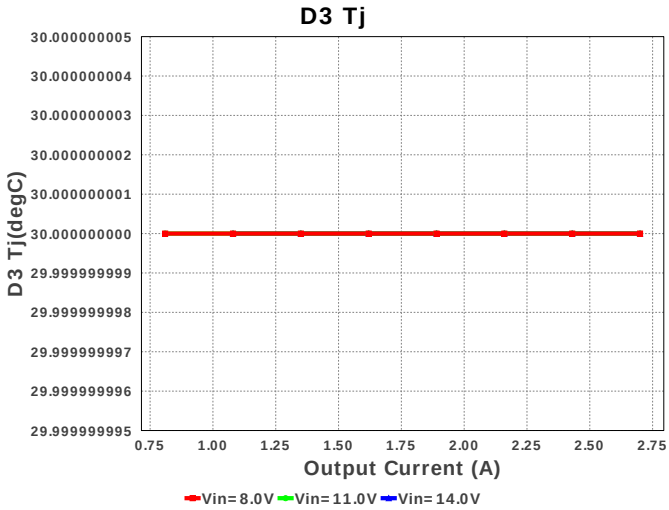
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Ccomp	MuRata	GRM033R71C561KA01D Series= X7R	Cap= 560.0 pF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
3.	Ccomp2	MuRata	GRM033R61A472KA01D Series= X5R	Cap= 4.7 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
4.	Cin	TDK	C3216X5R1E476M160AC Series= X5R	Cap= 47.0 uF ESR= 2.082 mOhm VDC= 25.0 V IRMS= 5.0279 A	2	$0.35	1206 11 mm²
5.	Cinx	TDK	C1005X7R1H104K Series= X7R	Cap= 100.0 nF ESR= 19.831 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.02	0402 3 mm²
6.	Cout	Panasonic	35SVPF82M Series= SVPF	Cap= 82.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 4.0 A	1	$0.61	CAPSMT_62_E12 106 mm²
7.	Coutx	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 mm²
8.	Coutx2	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 mm²

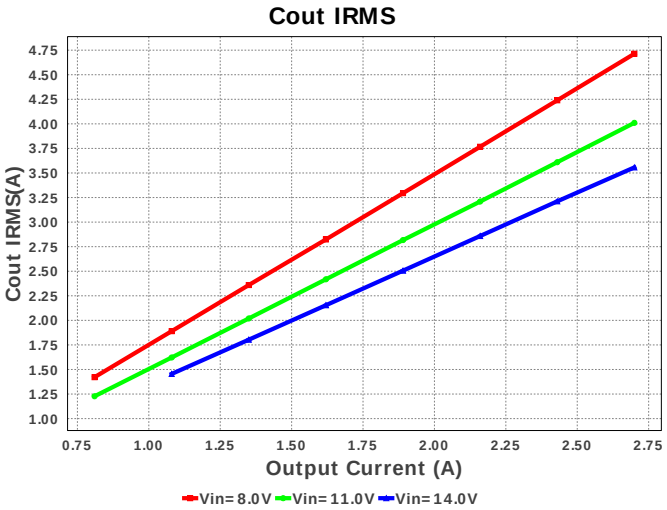
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cramp	MuRata	GRM033R71C561KA01D Series= X7R	Cap= 560.0 pF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	 0201 2 mm²
10.	Css	MuRata	GRM033C80G183KE01D Series= X6S	Cap= 18.0 nF VDC= 4.0 V IRMS= 0.0 A	1	$0.01	 0201 2 mm²
11.	Cvcc	Kemet	C0603C105K8PACTU Series= X5R	Cap= 1.0 uF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 0603 5 mm²
12.	D1	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50 mm²
13.	D2	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50 mm²
14.	D3	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50 mm²
15.	D4	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50 mm²
16.	L1	Coilcraft	XAL1010-103MEB	L= 10.0 µH DCR= 13.4 mOhm	1	$1.71	 XAL1010 160 mm²
17.	M1	Texas Instruments	CSD16323Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.44	 TRANS_NexFET_Q3 18 mm²
18.	M2	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 11.0 Amps	1	$0.23	 TRANS_NexFET_Q3A 18 mm²
19.	Rcomp	Vishay-Dale	CRCW040224K9FKED Series= CRCW..e3	Res= 24.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
20.	Renable	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Rfbb	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
22.	Rfbt	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
23.	Rramp	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
24.	Rsense	Susumu Co Ltd	RL7520WT-R010-F Series= RL7520W	Res= 10.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	$0.19	 0830 38 mm²
25.	Rt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
26.	Ruv1	Vishay-Dale	CRCW040215K4FKED Series= CRCW..e3	Res= 15.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

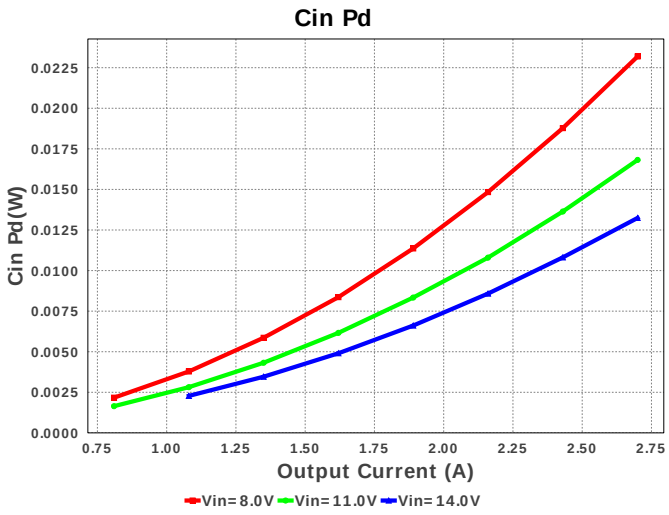
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	Ruv2	Vishay-Dale	CRCW04023K65FKED Series= CRCW..e3	Res= 3.65 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
28.	U1	Texas Instruments	LM5118MH/NOPB	Switcher	1	$2.86	MXA20A 71 mm^2

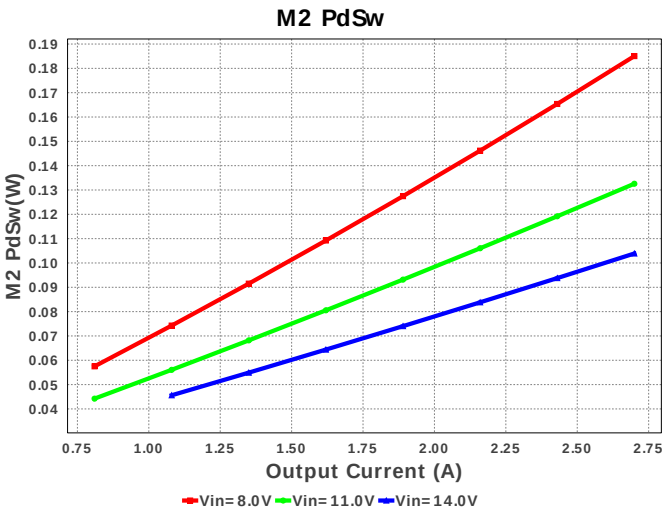


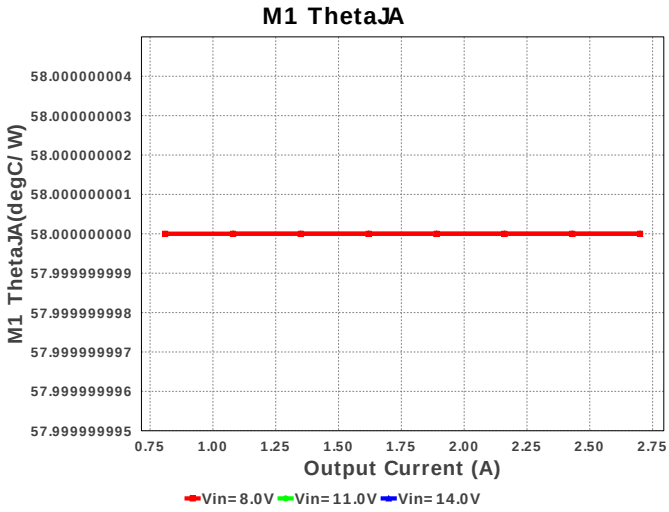


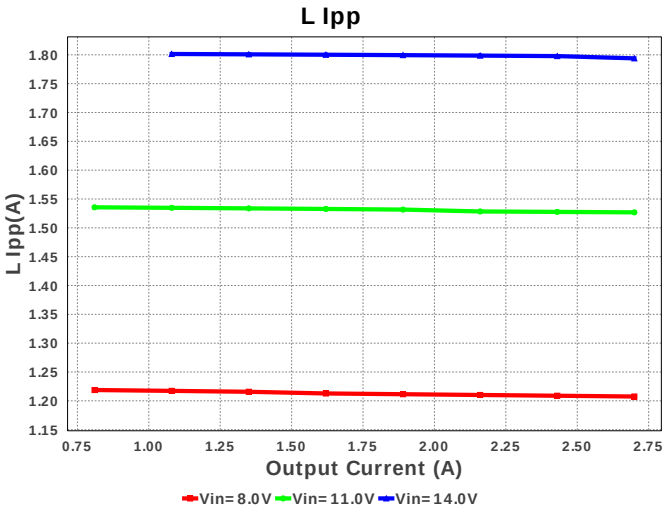


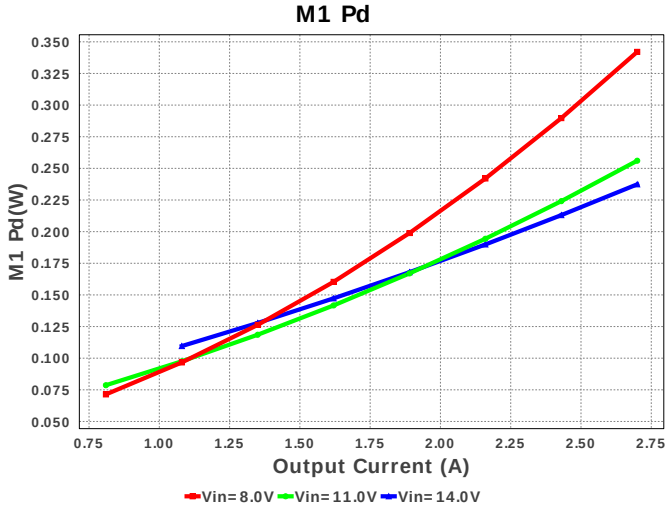


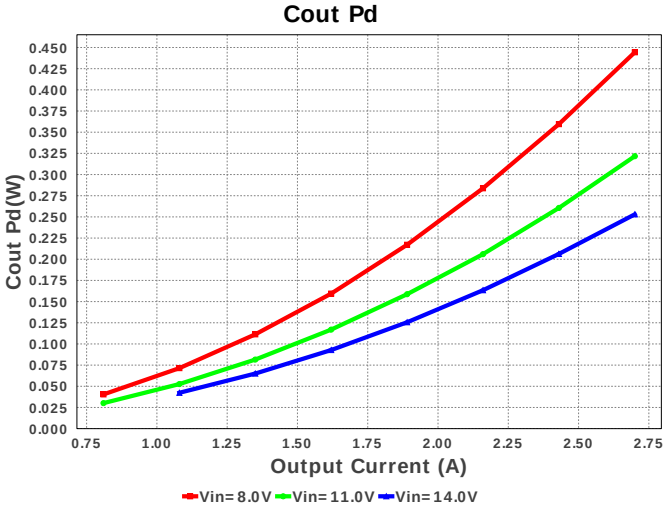


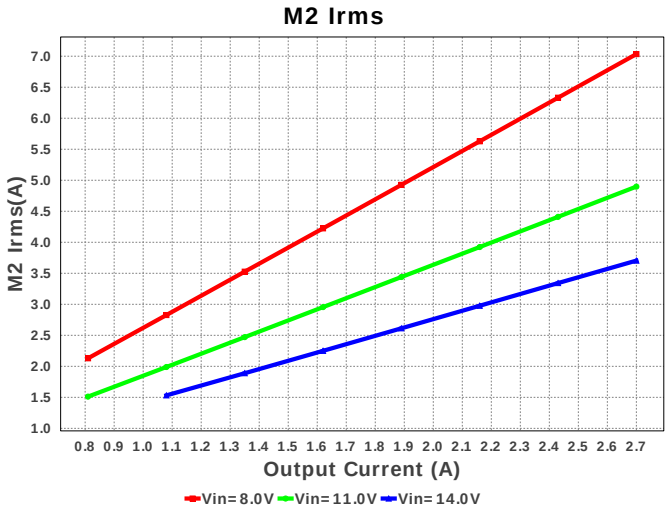


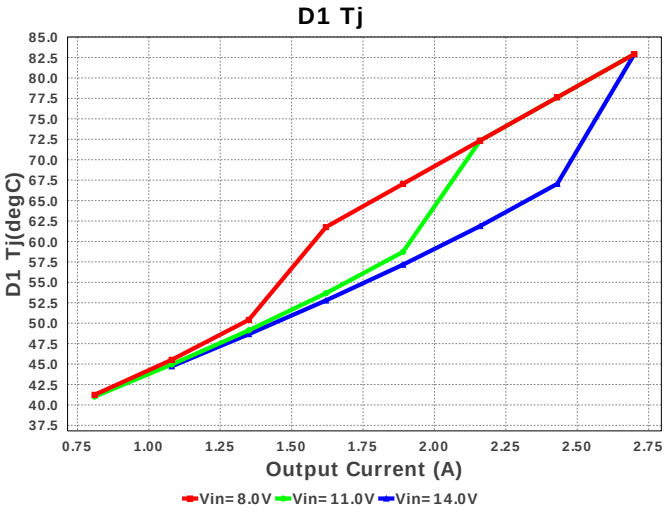


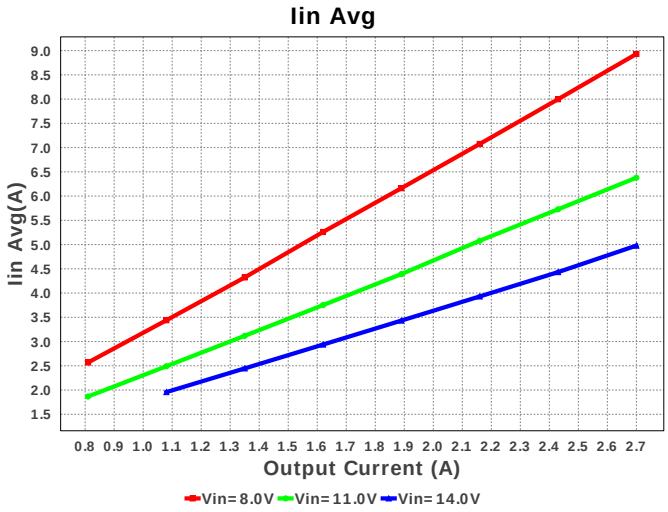


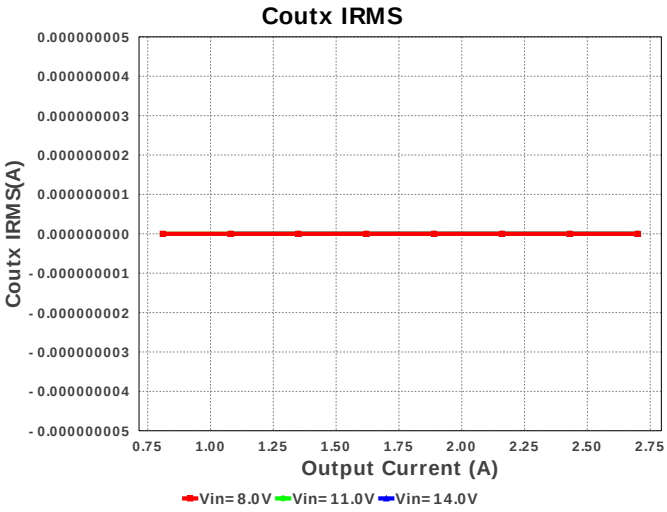


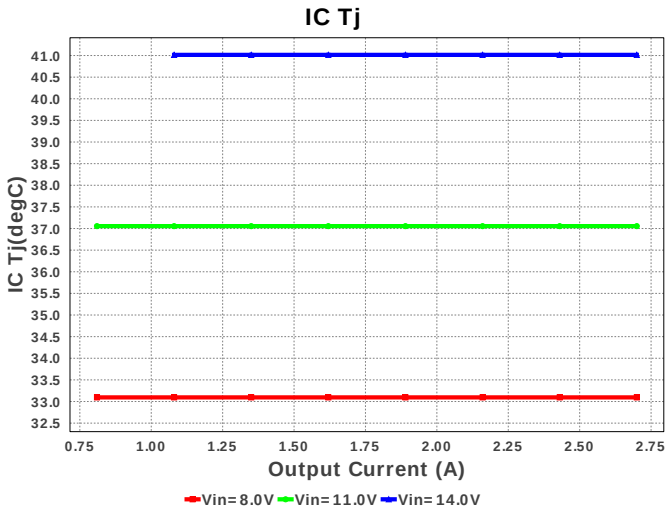


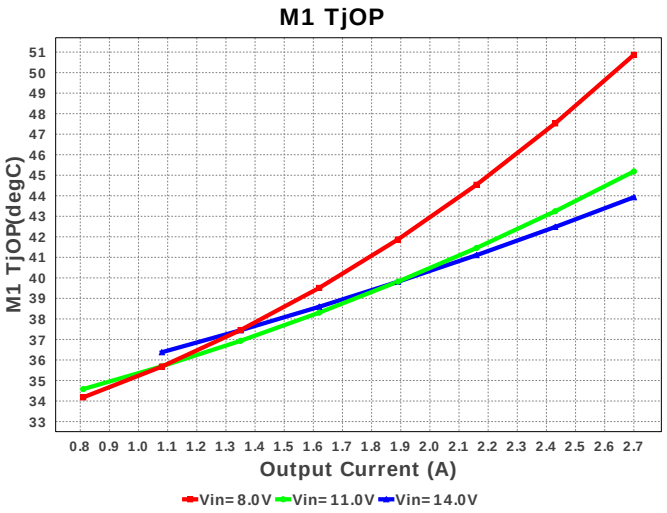




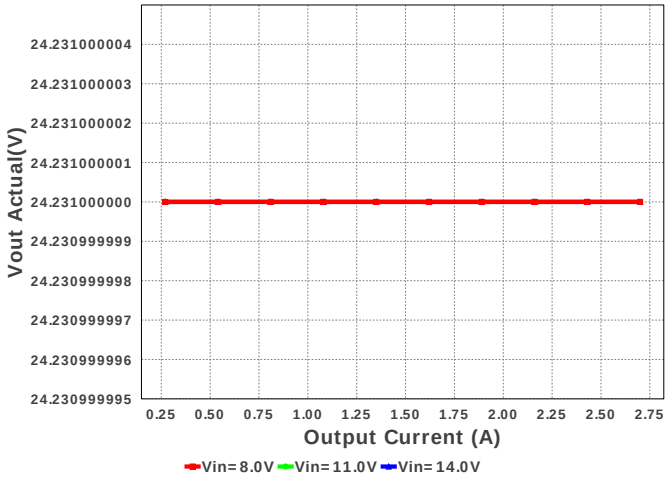




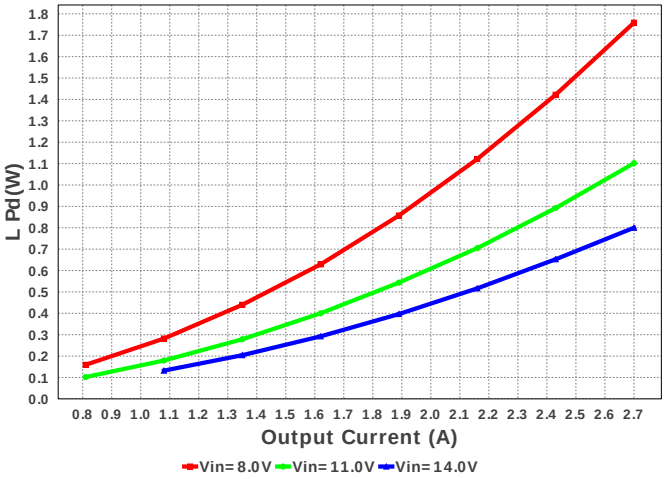




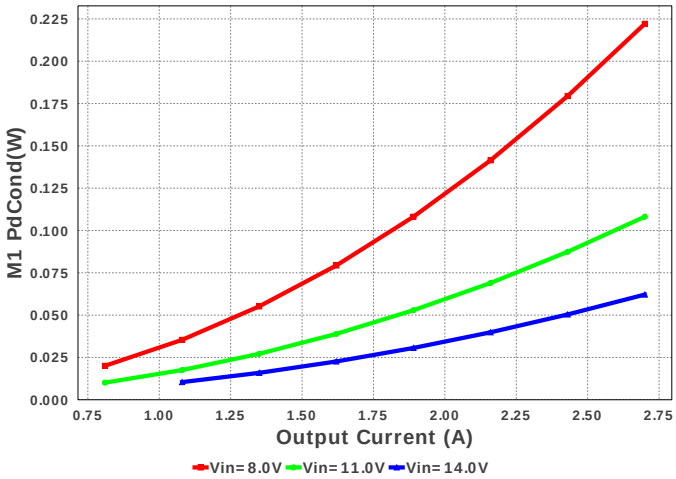
Vout Actual



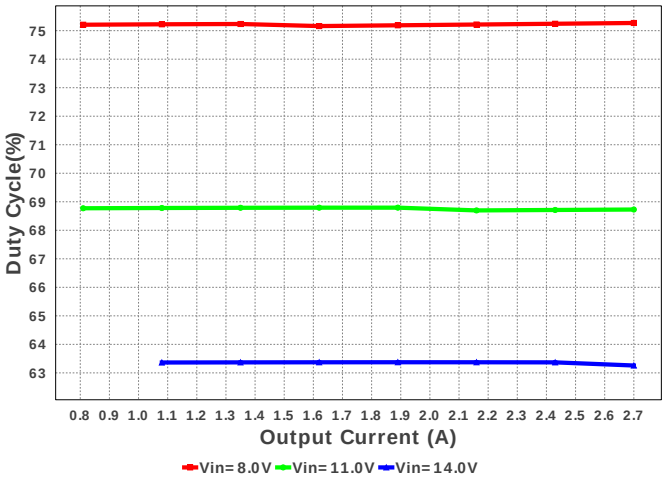
L Pd



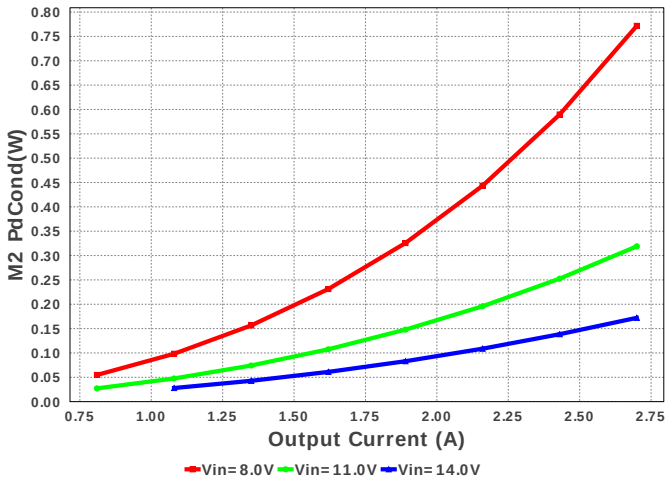
M1 PdCond



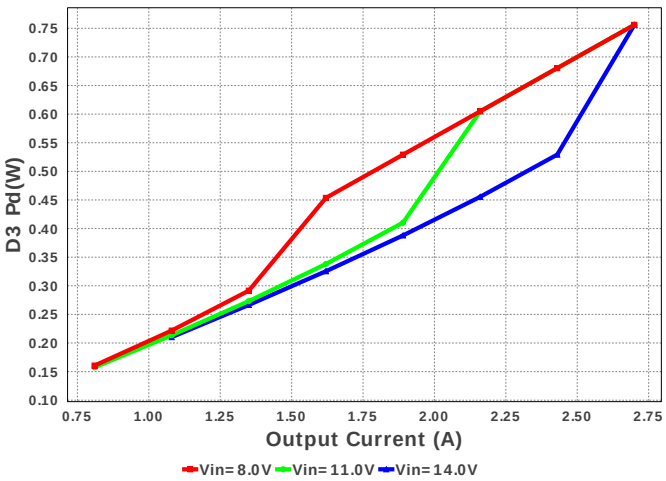
Duty Cycle

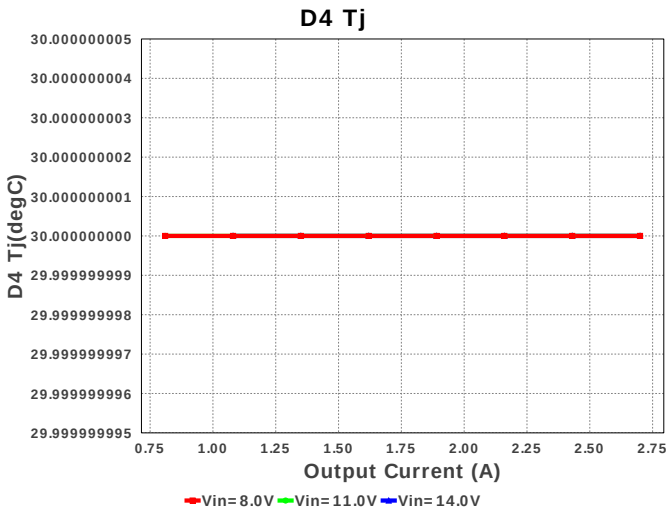


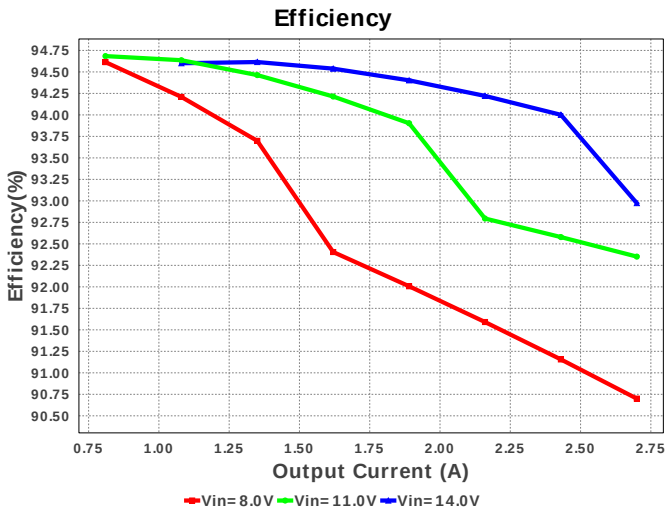
M2 PdCond

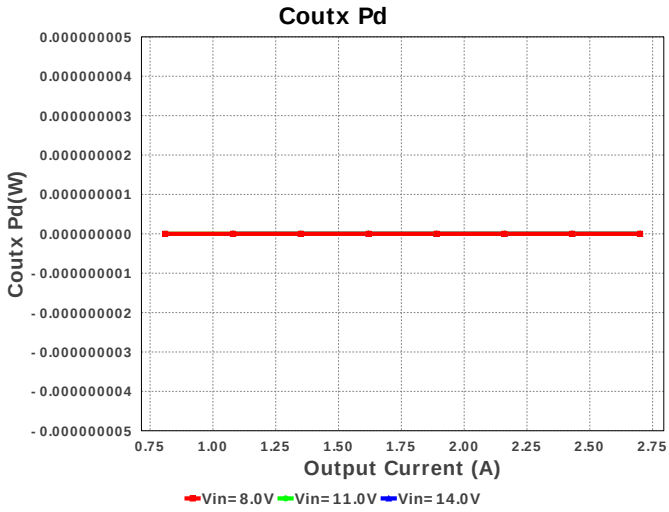


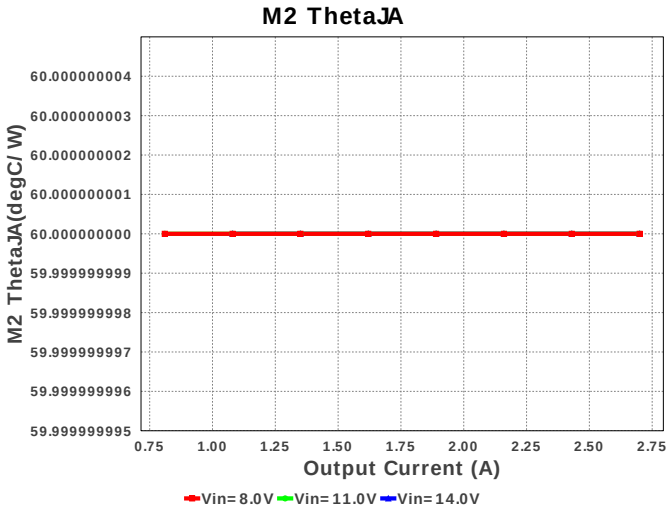
D3 Pd

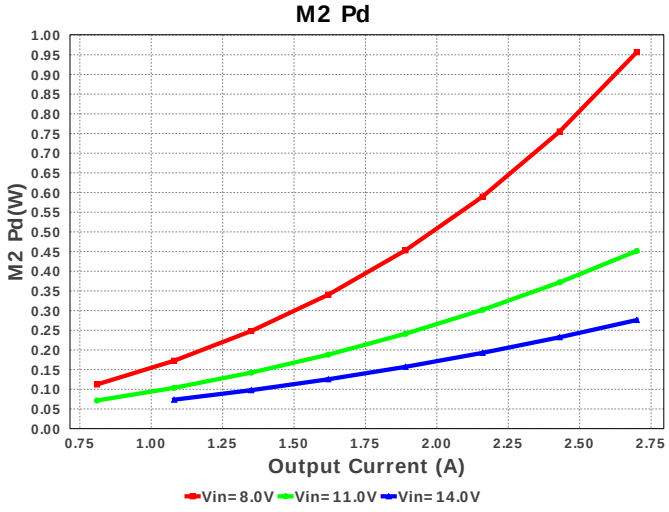


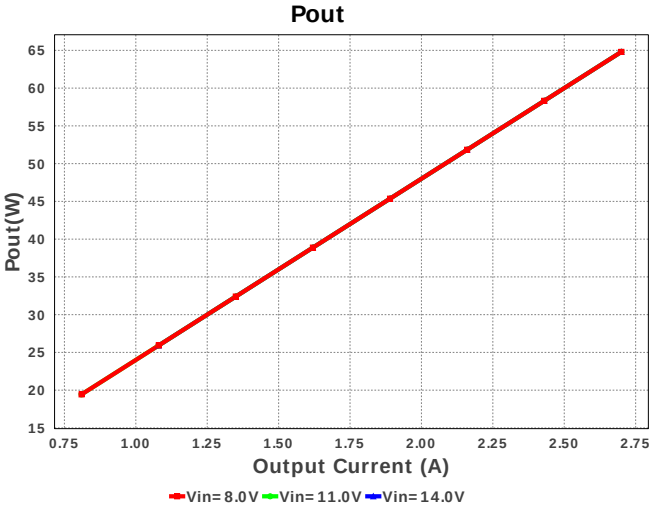


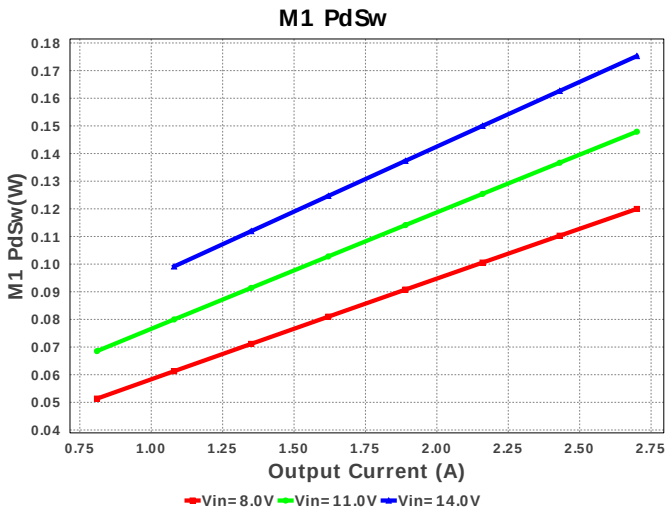


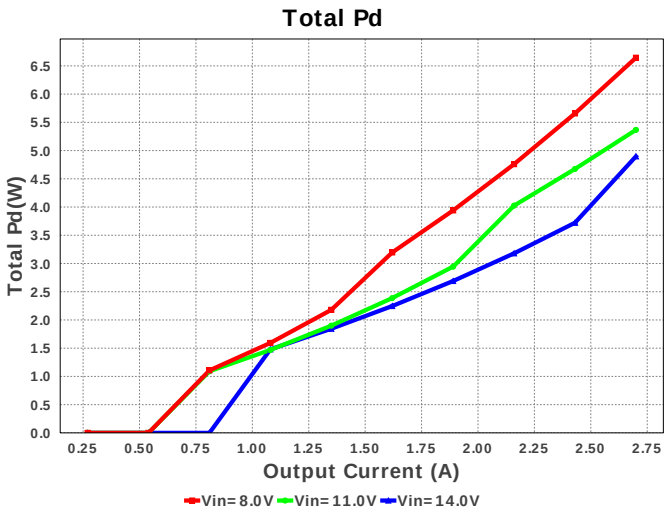


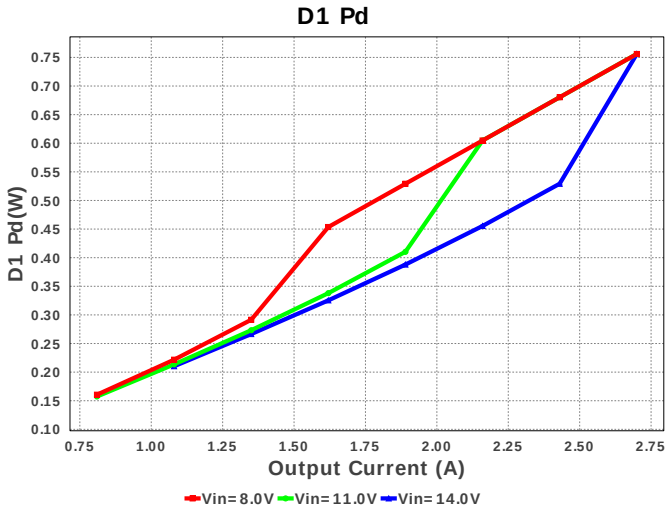


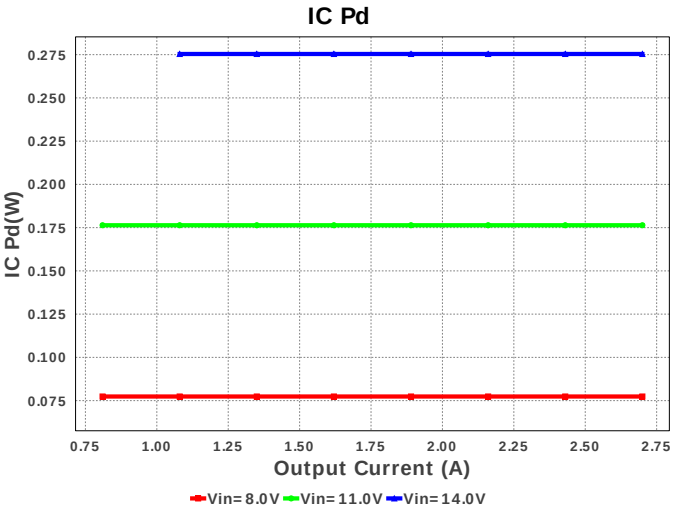


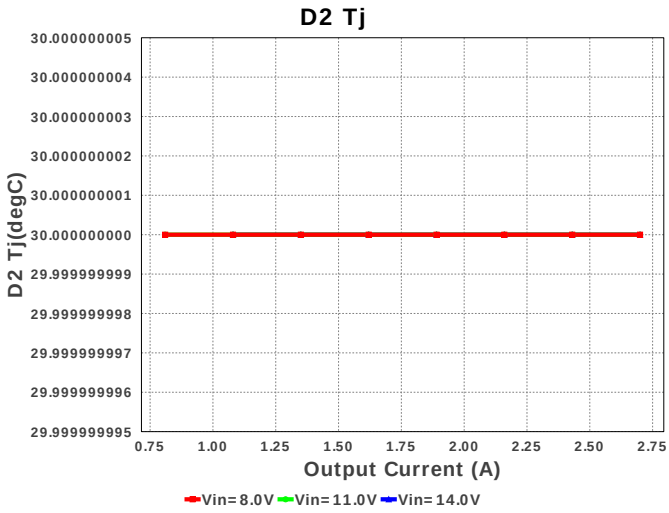


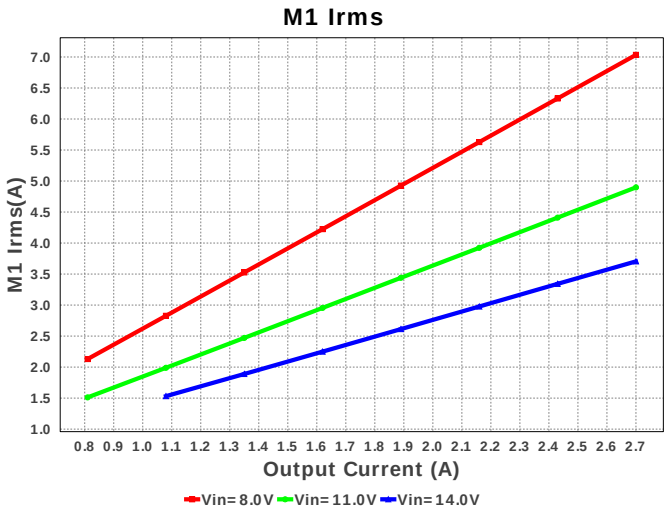


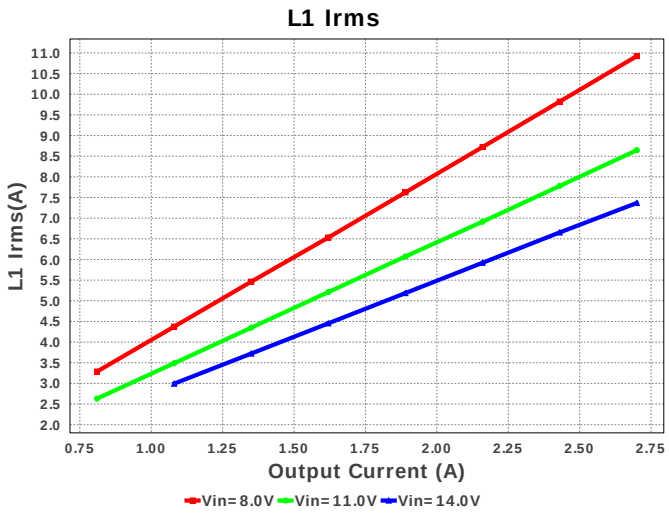


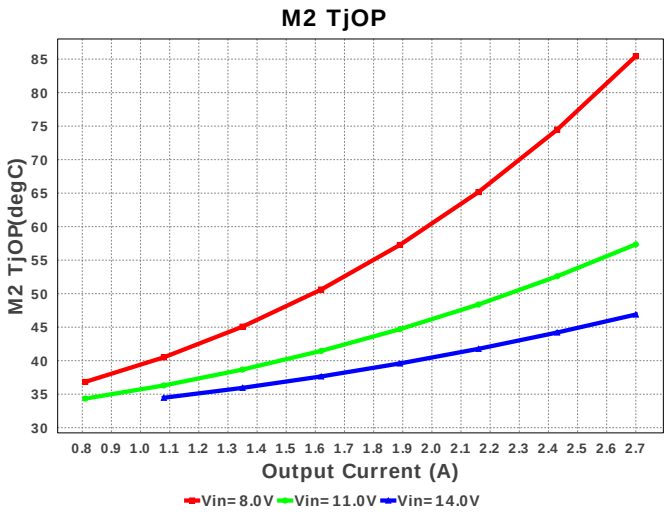


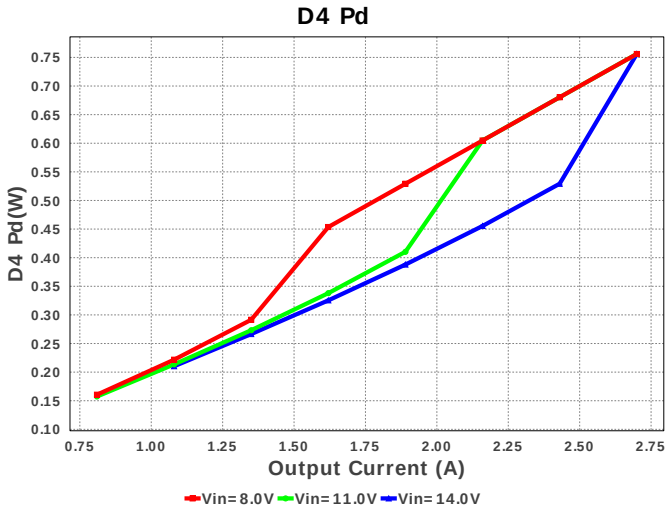


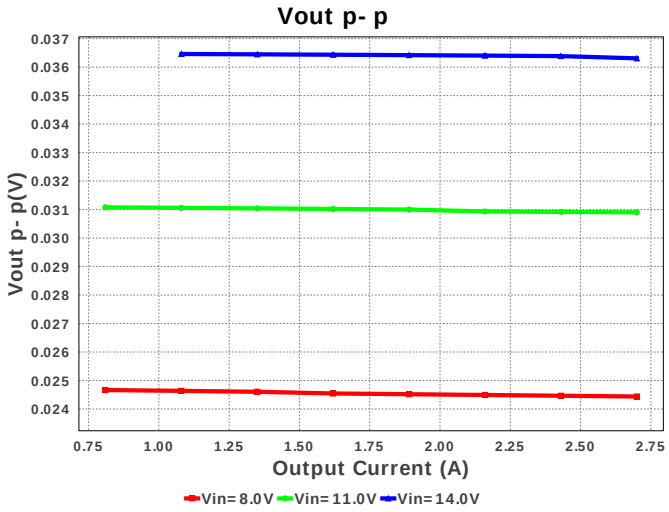


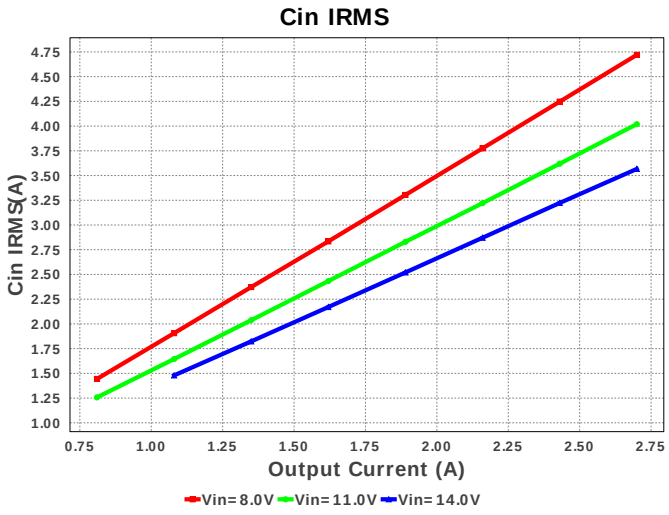


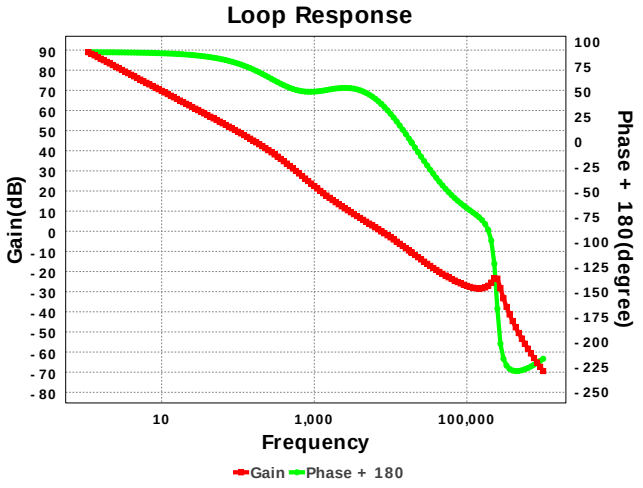












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	4.723 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	4.716 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	5.14 A	Current	Average input current
5.	L Ipp	1.206 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	10.932 A	Current	Inductor ripple current
7.	M1 Irms	7.035 A	Current	MOSFET RMS ripple current
8.	M2 Irms	7.035 A	Current	MOSFET RMS ripple current
9.	SW Ipk	11.529 A	Current	Peak switch current
10.	BOM Count	29	General	Total Design BOM count
11.	FootPrint	697.0 mm^2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Frequency	491.551 kHz	General	Switching frequency
13.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
14.	M1 ThetaJA	58.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	M2 ThetaJA	60.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	Pout	64.8 W	General	Total output power
17.	Total BOM	$9.41	General	Total BOM Cost
18.	D1 Tj	82.92 degC	Op_Point	D1 junction temperature
19.	D2 Tj	82.92 degC	Op_Point	D2 junction temperature
20.	D3 Tj	82.92 degC	Op_Point	D3 junction temperature
21.	D4 Tj	82.92 degC	Op_Point	D4 junction temperature
22.	Low Freq Gain	85.034 dB	Op_Point	Gain at 10Hz
23.	Vout Actual	24.231 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
24.	Vout OP	24.0 V	Op_Point	Operational Output Voltage
25.	Cross Freq	5.943 kHz	Op_point	Bode plot crossover frequency
26.	Duty Cycle	75.289 %	Op_point	Duty cycle
27.	Efficiency	90.059 %	Op_point	Steady state efficiency
28.	Gain Marg	-5.134 dB	Op_point	Bode Plot Gain Margin
29.	IC Tj	41.015 degC	Op_point	IC junction temperature
30.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
31.	IOUT_OP	2.7 A	Op_point	Iout operating point
32.	M1 TjOP	50.868 degC	Op_point	MOSFET junction temperature
33.	M2 TjOP	85.464 degC	Op_point	MOSFET junction temperature
34.	Phase Marg	27.892 deg	Op_point	Bode Plot Phase Margin
35.	VIN_OP	8.0 V	Op_point	Vin operating point
36.	Vout p-p	24.419 mV	Op_point	Peak-to-peak output ripple voltage
37.	Cin Pd	23.216 mW	Power	Input capacitor power dissipation
38.	Cout Pd	444.815 mW	Power	Output capacitor power dissipation
39.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
40.	D1 Pd	756.0 mW	Power	Diode power dissipation
41.	D2 Pd	756.0 mW	Power	Diode2 power dissipation
42.	D3 Pd	756.0 mW	Power	Diode3 power dissipation
43.	D4 Pd	756.0 mW	Power	Diode4 power dissipation
44.	IC Pd	275.38 mW	Power	IC power dissipation
45.	L Pd	1.761 W	Power	Inductor power dissipation
46.	M1 Pd	400.599 mW	Power	MOSFET power dissipation
47.	M1 PdCond	280.642 mW	Power	M1 MOSFET conduction losses
48.	M1 PdSw	119.958 mW	Power	M1 MOSFET switching losses
49.	M2 Pd	1.205 W	Power	MOSFET power dissipation
50.	M2 PdCond	1.02 W	Power	M2 MOSFET conduction losses
51.	M2 PdSw	185.041 mW	Power	M2 MOSFET switching losses
52.	Total Pd	4.087 W	Power	Total Power Dissipation
53.	Vout Tolerance	3.409 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.7	Maximum Output Current
2.	SoftStart	2.0 ms	Soft Start Time (ms)
3.	VinMax	14.0	Maximum input voltage
4.	VinMin	8.0	Minimum input voltage
5.	Vout	24.0	Output Voltage
6.	base_pn	LM5118	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	30.0	Ambient temperature
9.	UserFsw	294.659 k	Customer Selected Frequency

Design Assistance

1. The LM5118 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. **LM5118** Product Folder : http://www.ti.com/product/lm5118 : contains the data sheet and other resources.