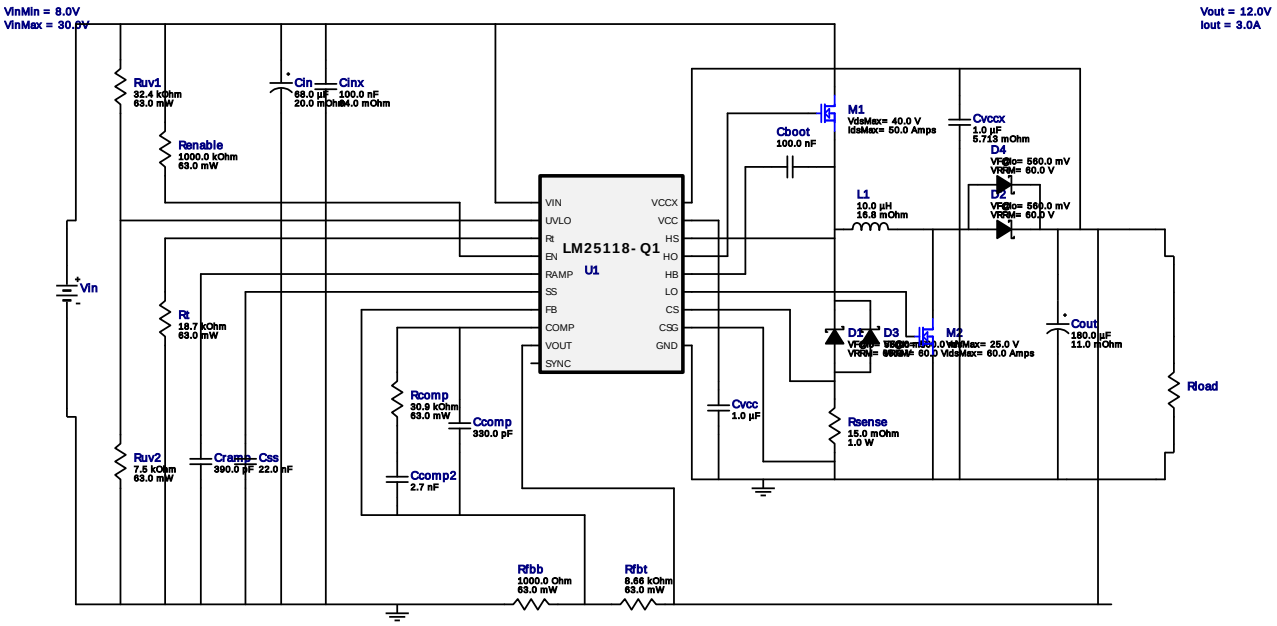
WEBENCH® Design Report

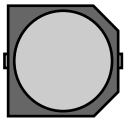
VinMin = 8.0V
VinMax = 30.0V
Vout = 12.0V
Iout = 3.0A

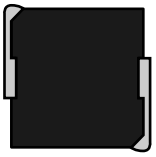
Device = LM25118Q1MH/NOPB
Topology = Buck_Boost
Created = 3/25/15 8:00:50 AM
BOM Cost = $8.51
Footprint = 896.0 mm^2
BOM Count = 26
Total Pd = 3.41W

Design : 1231947/61 LM25118Q1MH/NOPB
LM25118Q1MH/NOPB 8.0V-30.0V to 12.00V @ 3.0A

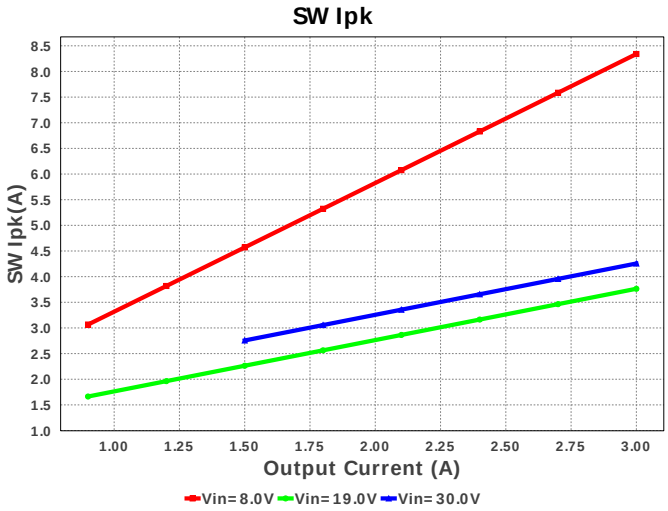


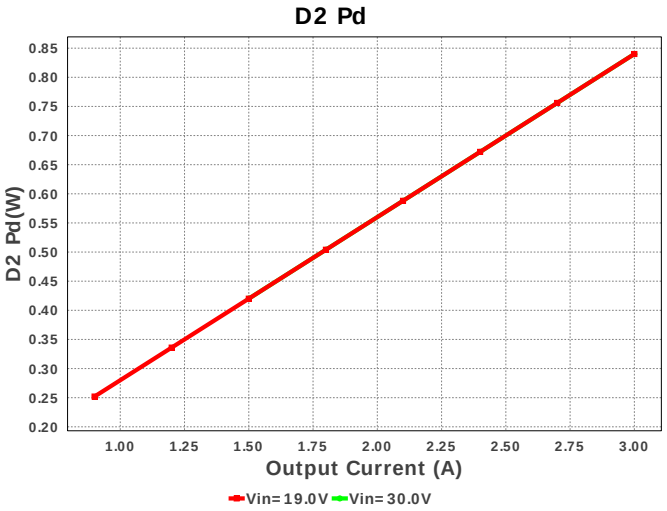
Electrical BOM

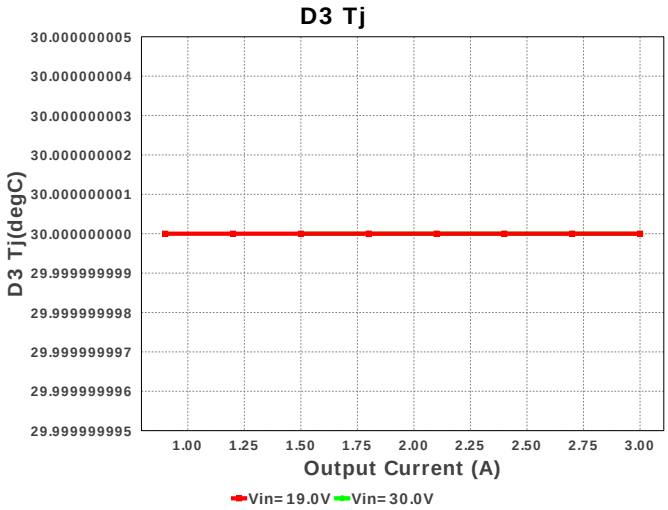
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
2.	Ccomp	Samsung Electro-Mechanics	CL21C331JBANFNC Series= C0G	Cap= 330.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
3.	Ccomp2	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Cin	Panasonic	50SVPF68M Series= 1273	Cap= 68.0 uF ESR= 20.0 mOhm VDC= 50.0 V IRMS= 4.3 A	1	$0.92	 CAPSMT_62_F12 151 mm^2
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 mm^2
6.	Cout	Panasonic	16SVPE180M Series= 259	Cap= 180.0 uF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 4.46 A	1	$0.49	 CAPSMT_62_C10 74 mm^2
7.	Cramp	Yageo America	CC0805KRX7R9BB391 Series= X7R	Cap= 390.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
8.	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

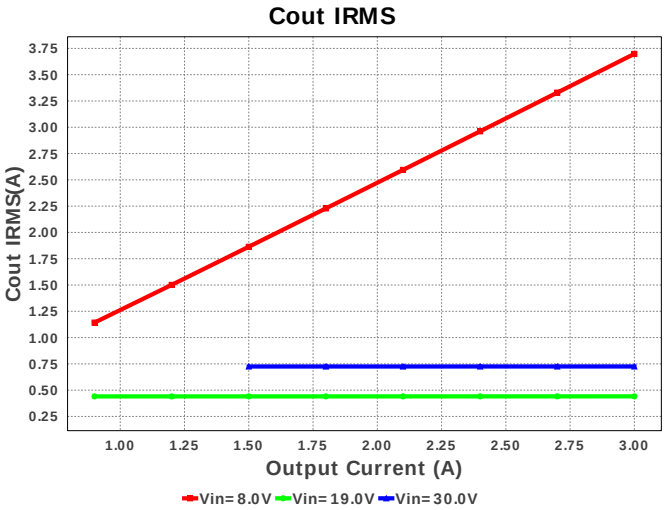
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cvcc	MuRata	GRM155R61A105KE15D Series= X5R	Cap= 1.0 uF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
10.	Cvccx	TDK	C1608X5R1C105K Series= X5R	Cap= 1.0 uF ESR= 5.713 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	 0603 5 mm²
11.	D1	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50 mm²
12.	D2	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50 mm²
13.	D3	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50 mm²
14.	D4	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50 mm²
15.	L1	Bourns	SRP1270-100M	L= 10.0 µH DCR= 16.8 mOhm	1	$0.60	 SRP1270 246 mm²
16.	M1	Texas Instruments	CSD18504Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.56	 TRANS_NexFET_Q5A 55 mm²
17.	M2	Texas Instruments	CSD16340Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.44	 TRANS_NexFET_Q3 19 mm²
18.	Rcomp	Vishay-Dale	CRCW040230K9FKED Series= CRCW..e3	Res= 30.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
19.	Renable	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
20.	Rfbb	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Rfbt	Vishay-Dale	CRCW04028K66FKED Series= CRCW..e3	Res= 8.66 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
22.	Rsense	Susumu Co Ltd	PRL1632-R015-F-T1 Series= 237	Res= 15.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	 1206 11 mm²
23.	Rt	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
24.	Ruv1	Vishay-Dale	CRCW040232K4FKED Series= CRCW..e3	Res= 32.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
25.	Ruv2	Vishay-Dale	CRCW04027K50FKED Series= CRCW..e3	Res= 7.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

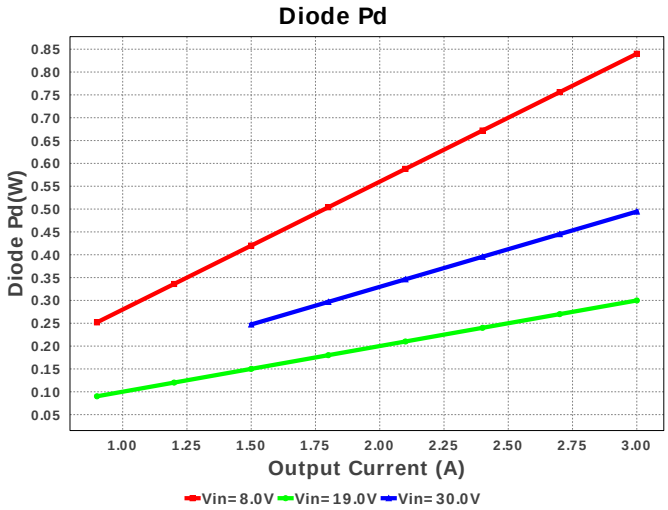
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	U1	Texas Instruments	LM25118Q1MH/NOPB	Switcher	1	$2.76	 MXA20A 71 mm²

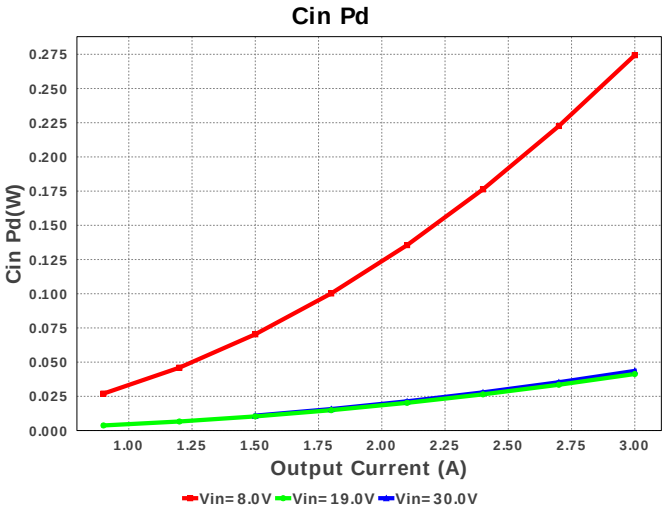


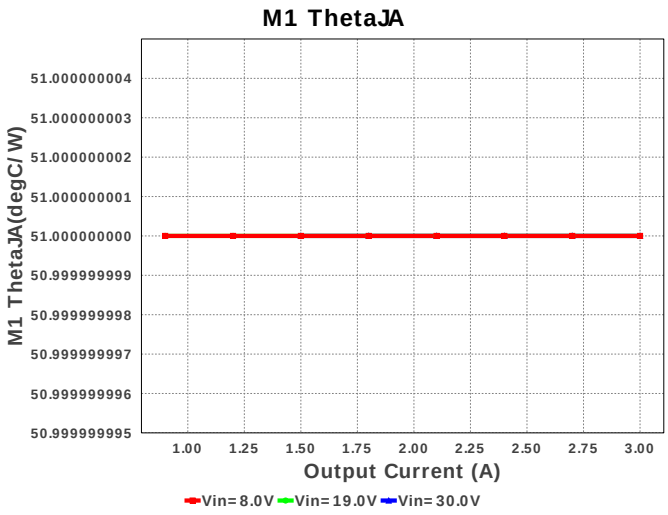


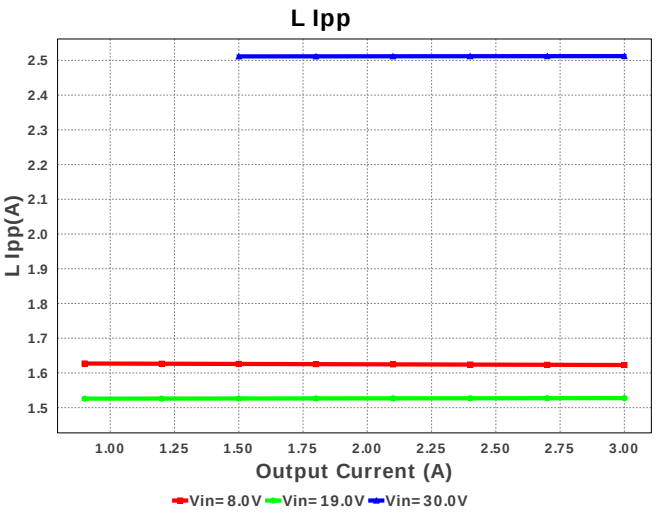


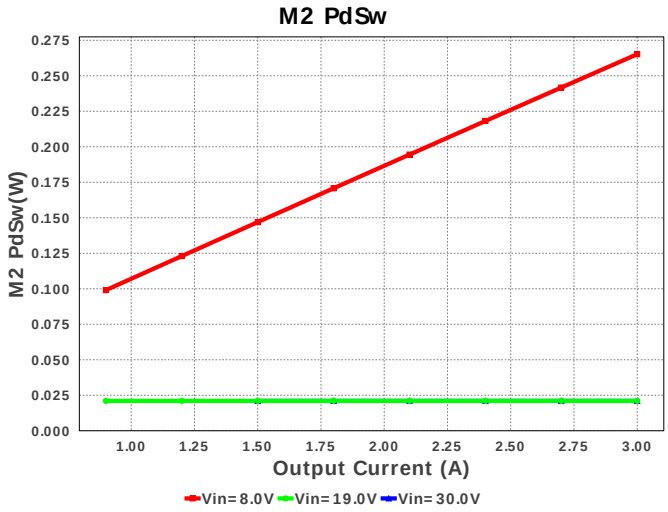


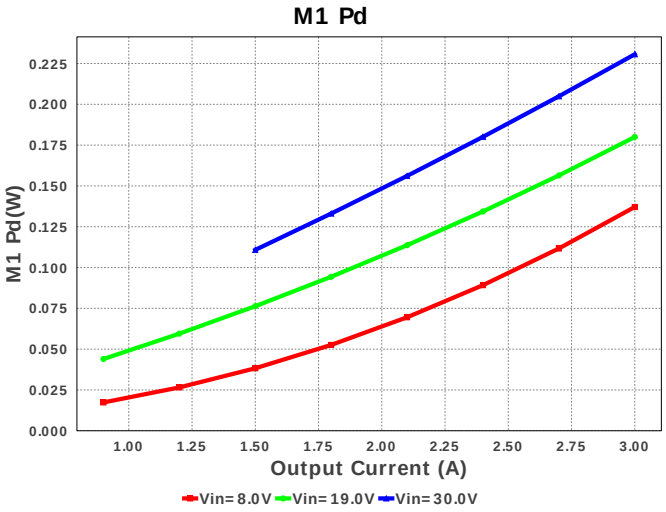


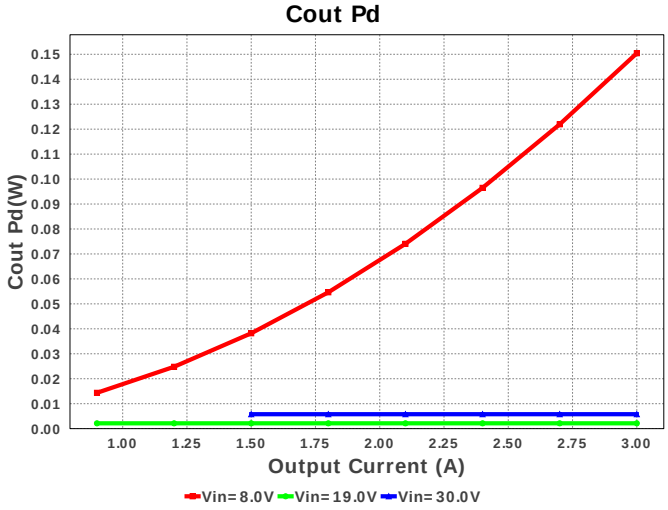


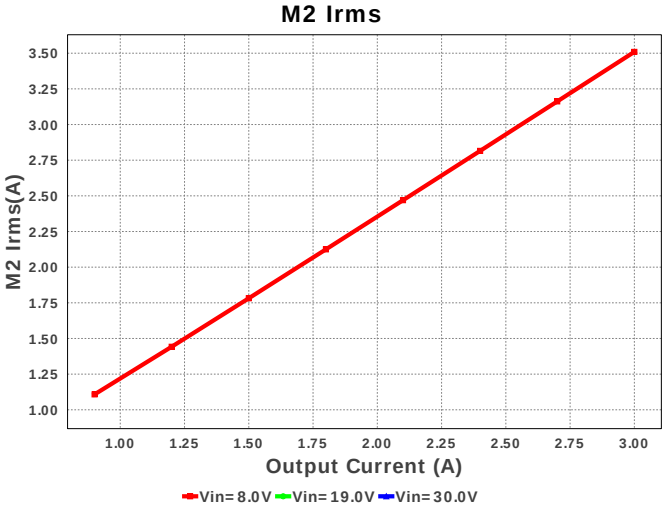


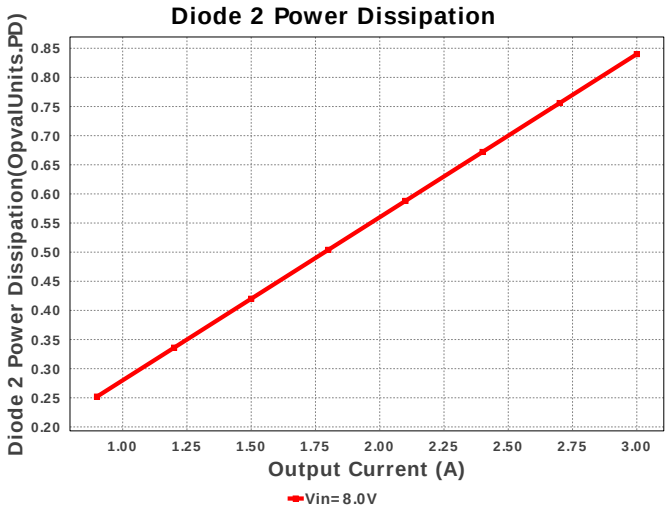


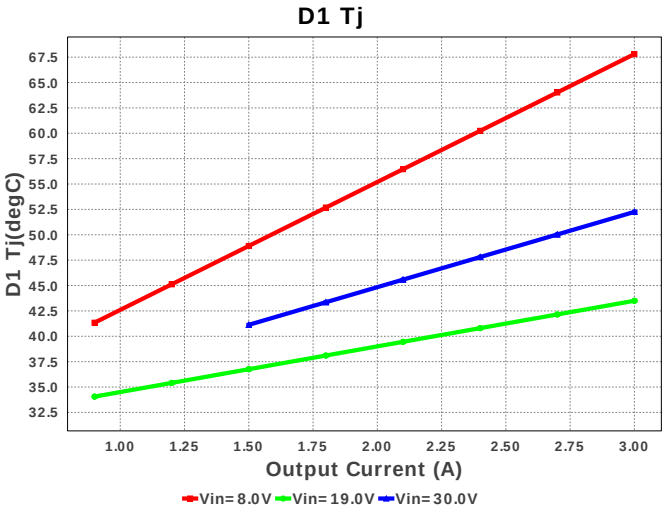


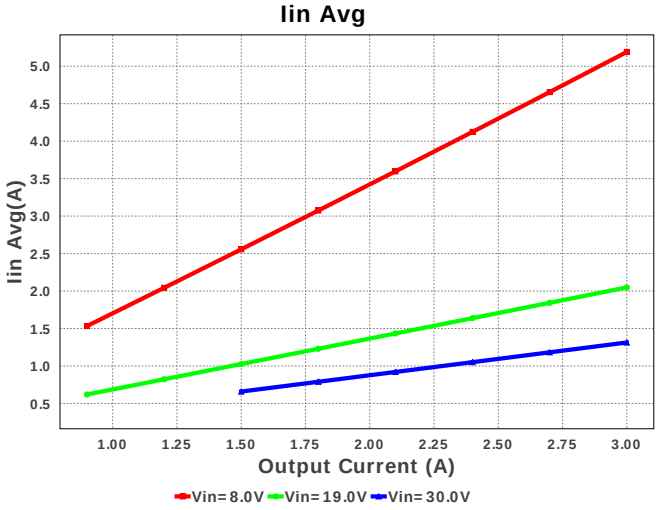


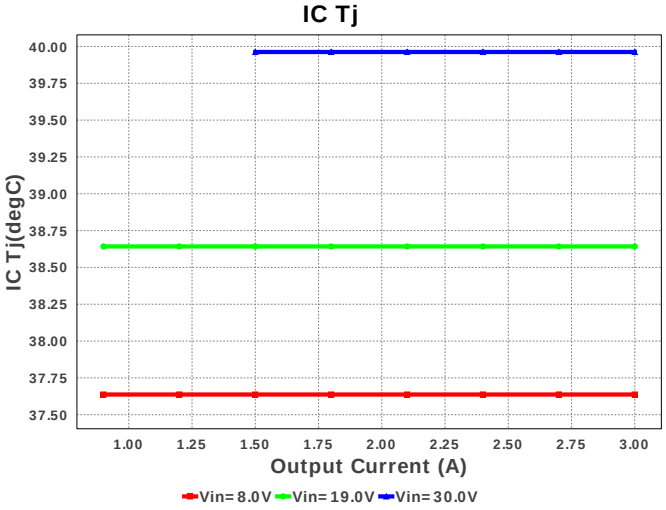


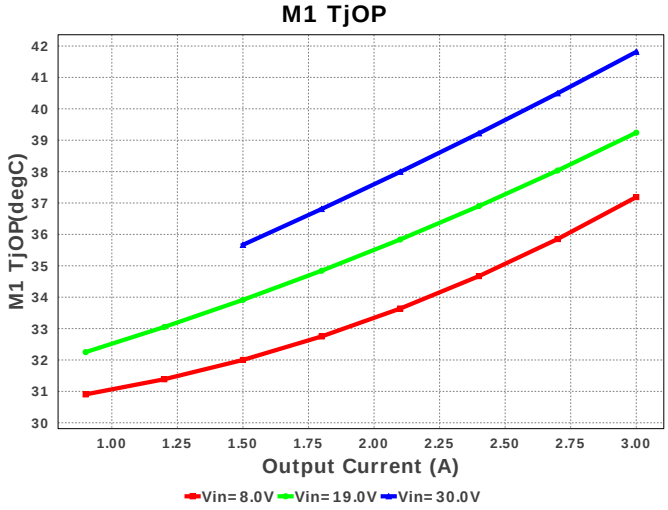


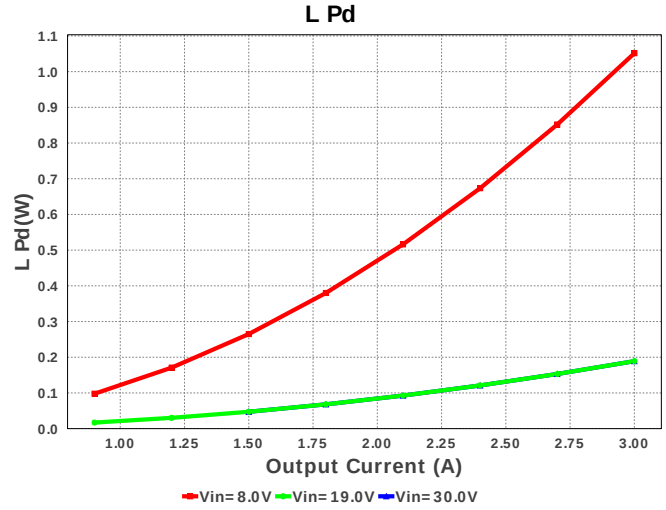


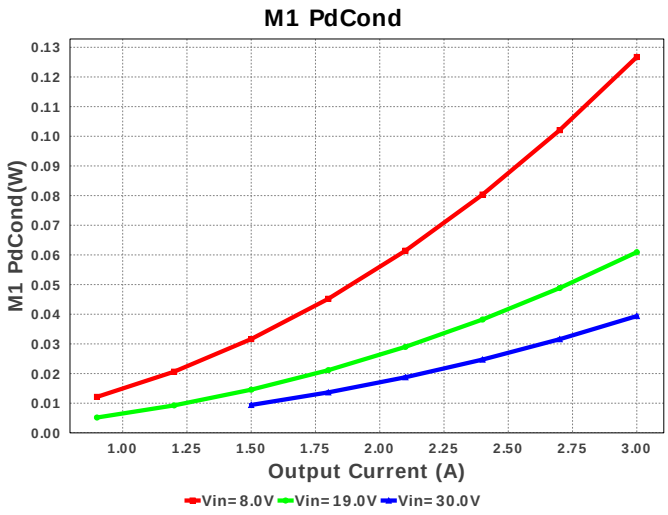


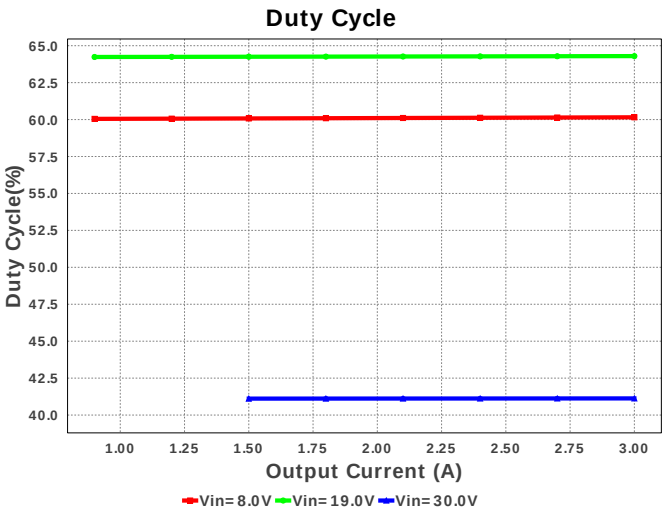


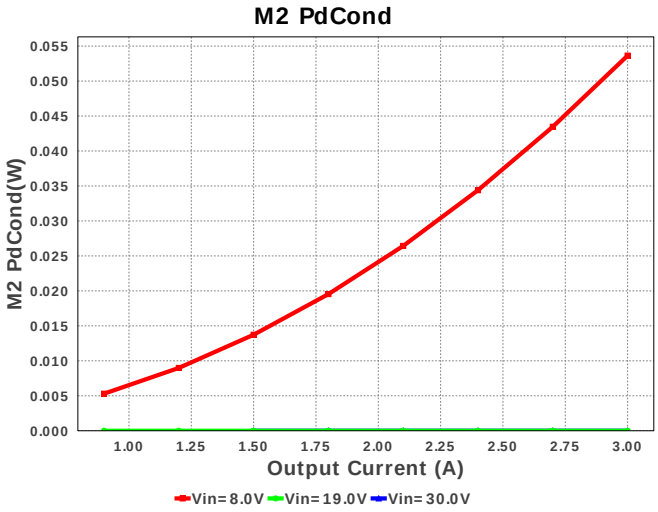


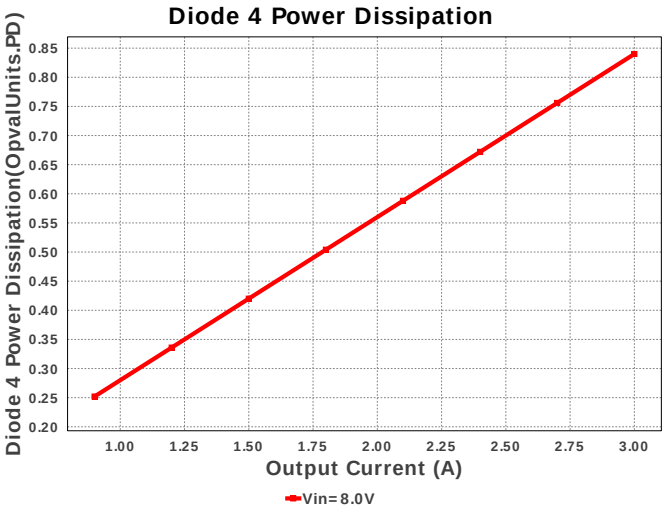


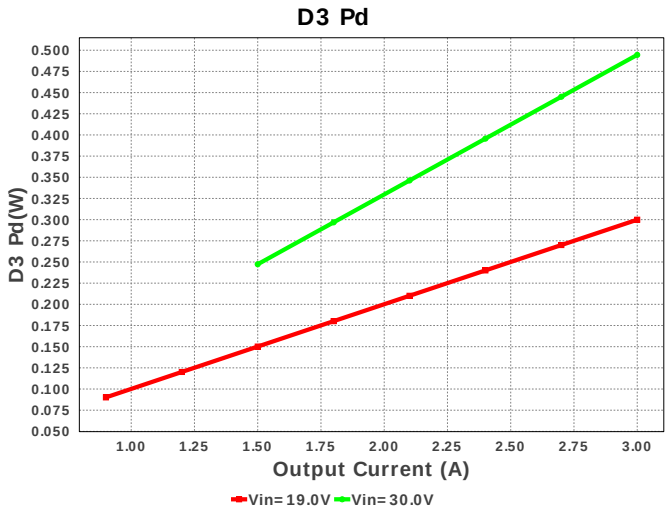


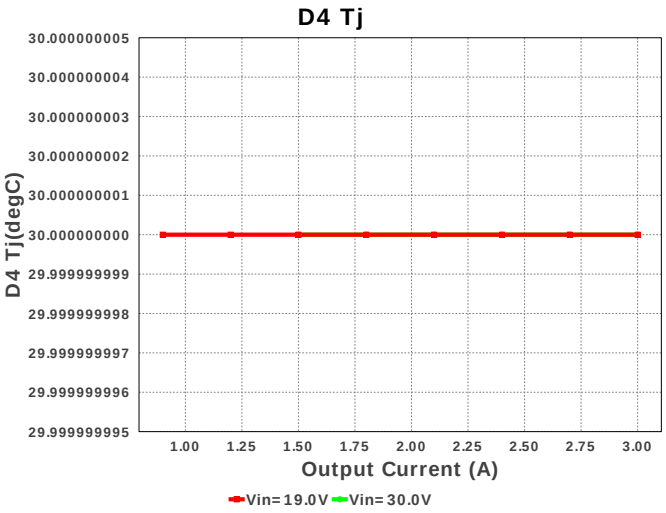


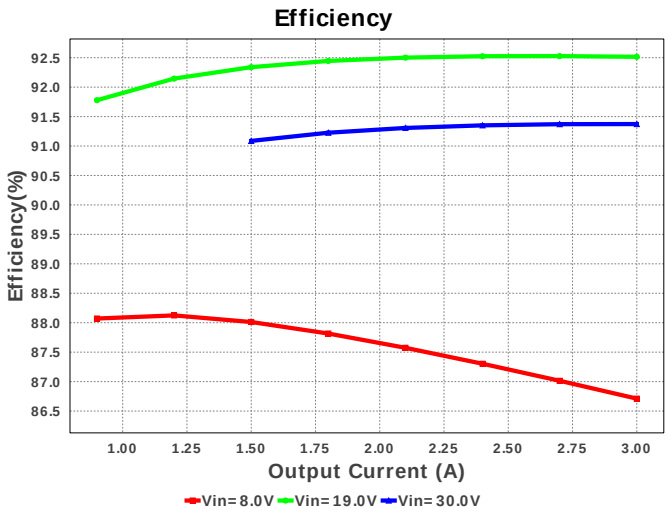


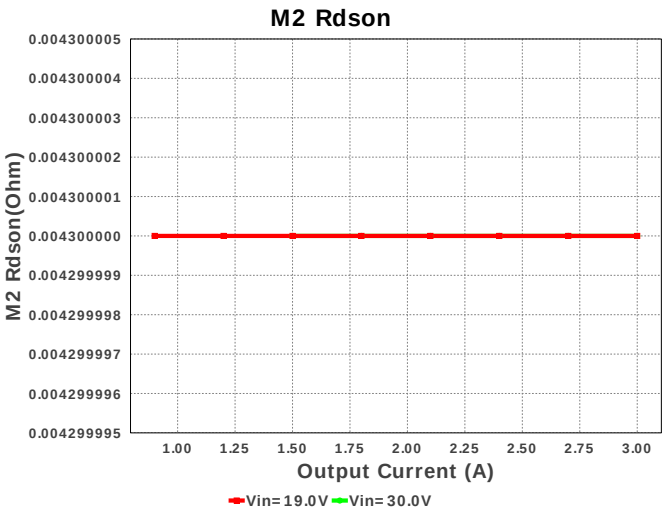


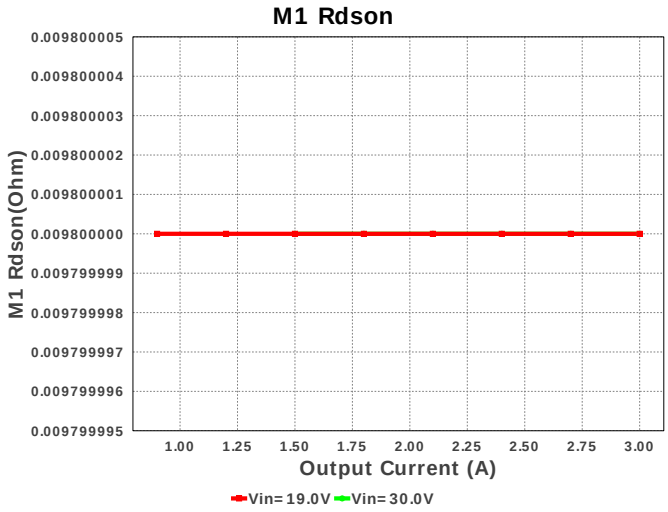


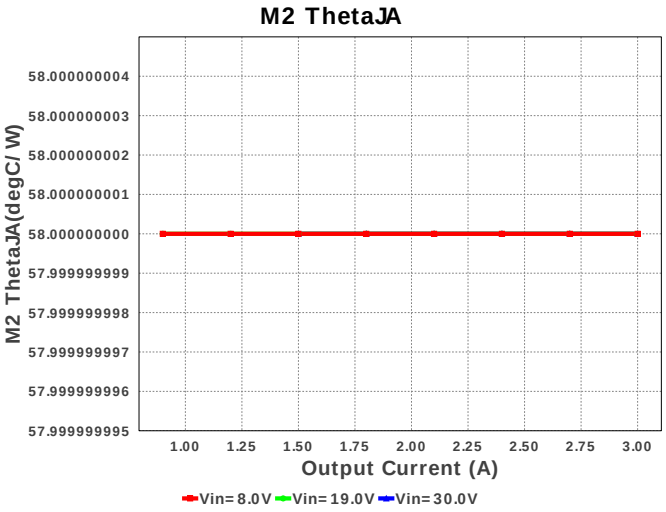


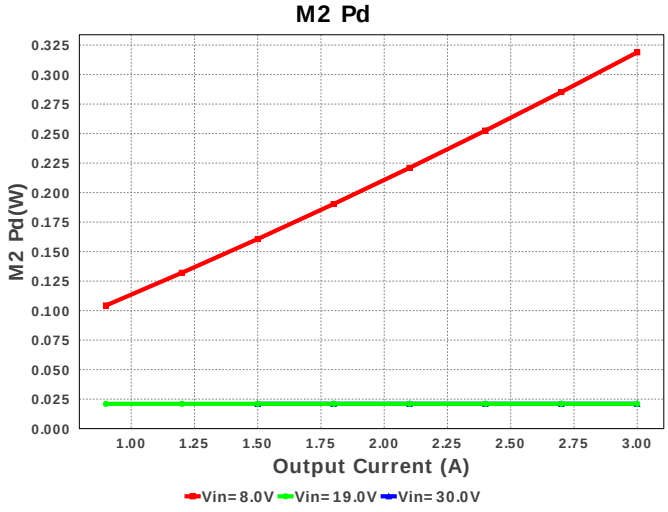


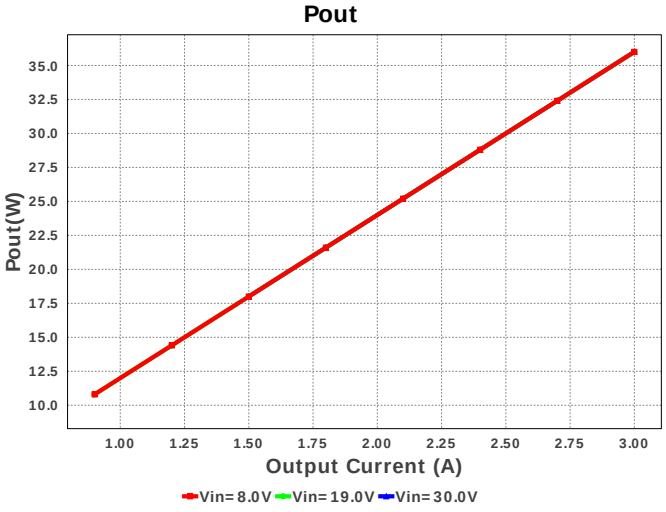


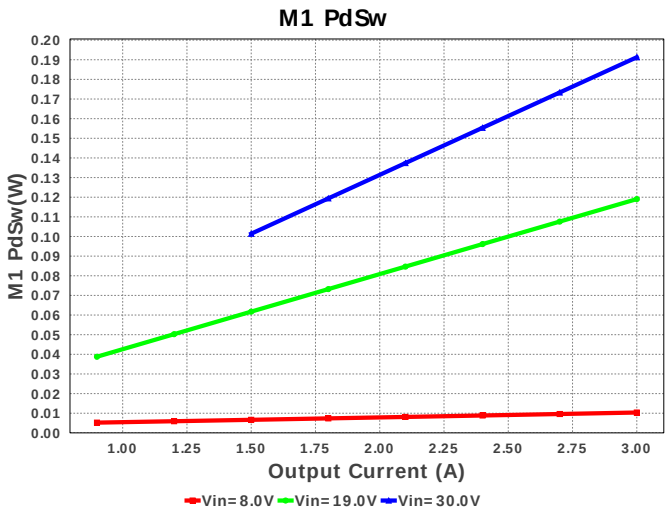


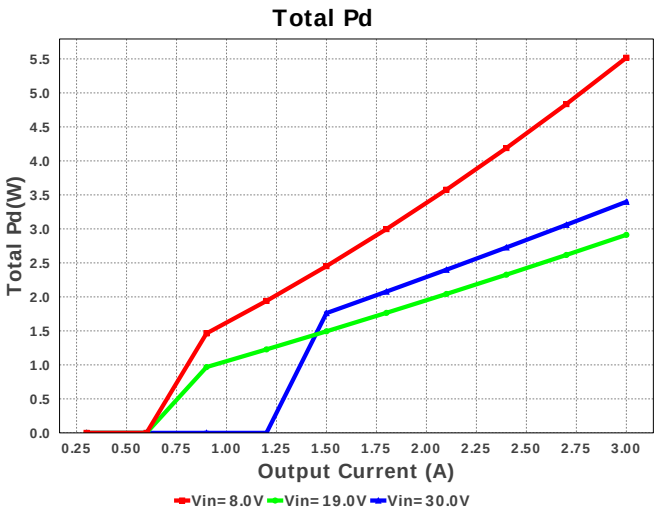


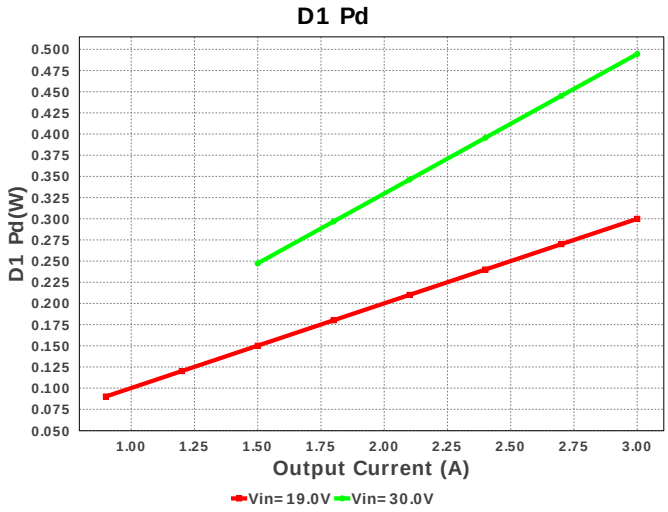


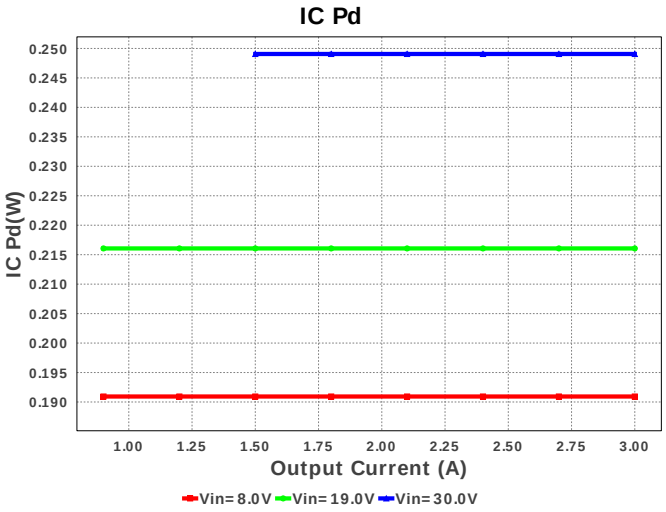


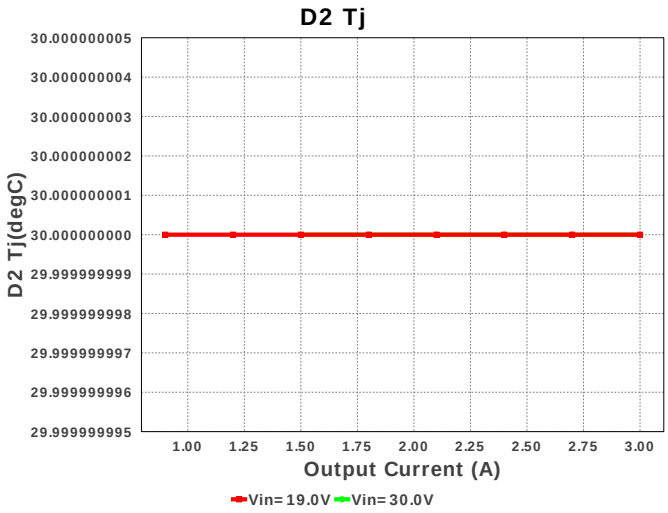


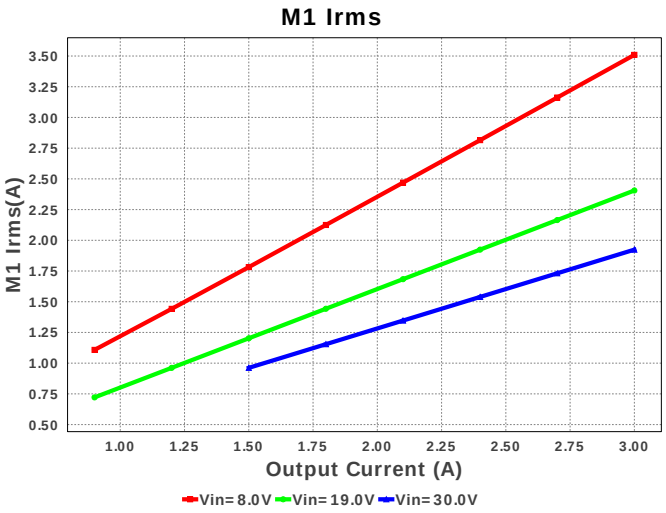


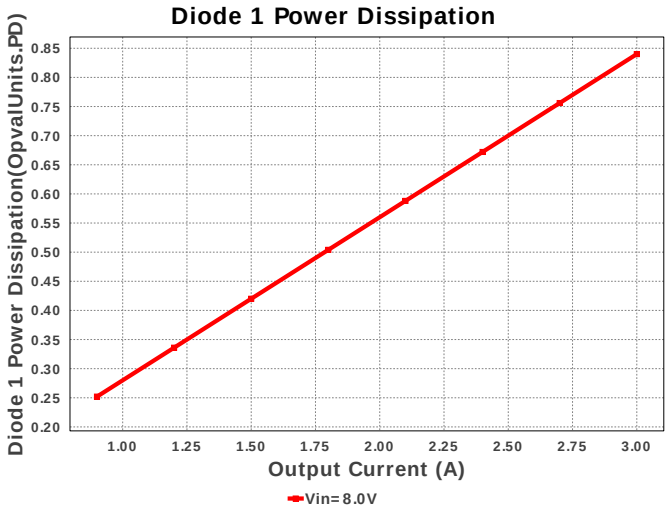


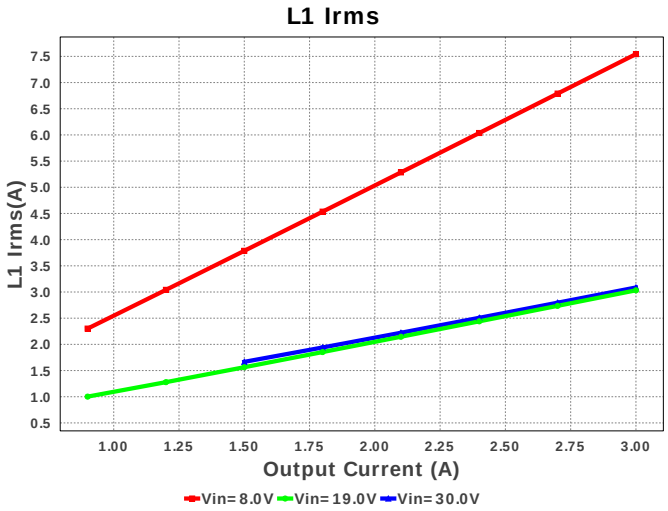


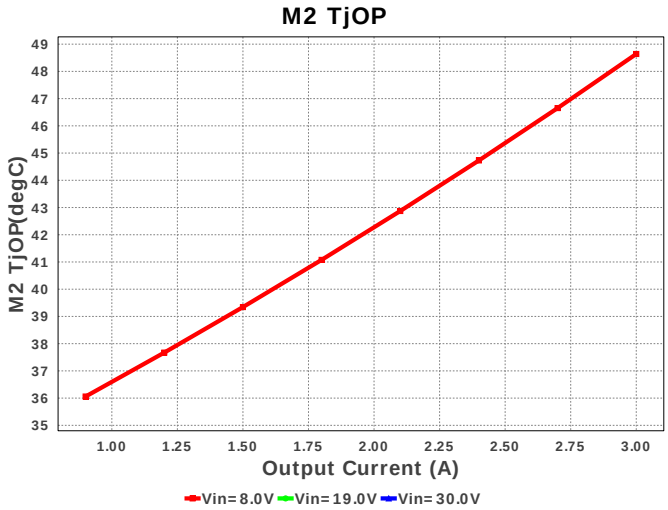


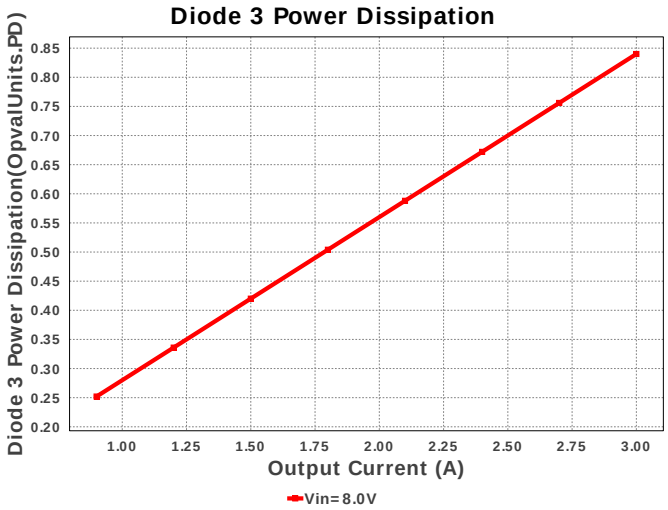


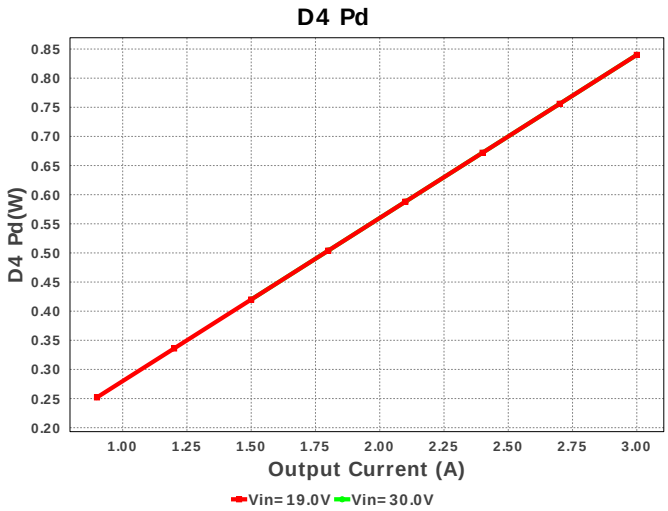


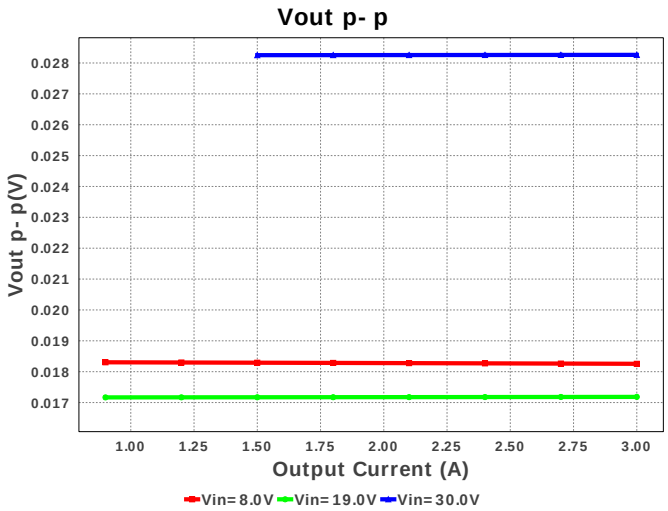


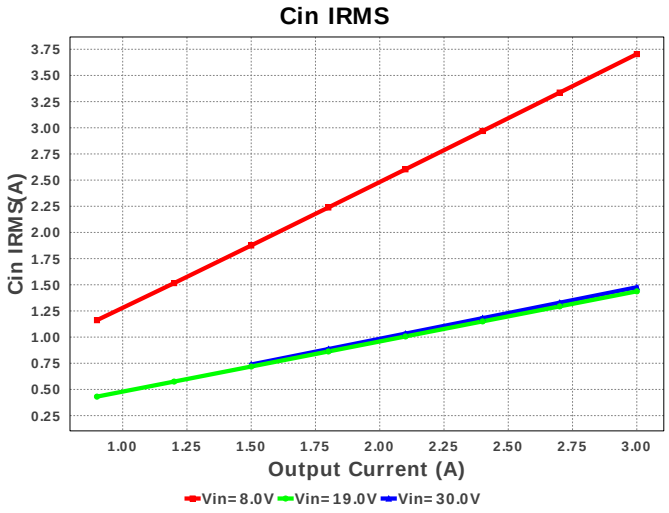


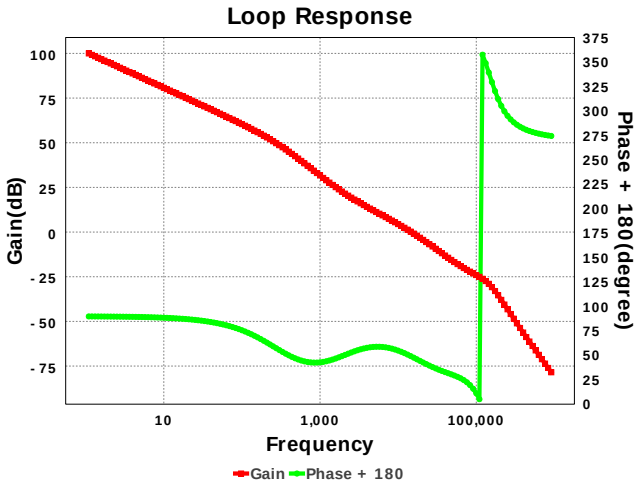












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.476 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	725.395 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	1.314 A	Current	Average input current
4.	L Ipp	2.513 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	3.086 A	Current	Inductor ripple current
6.	M1 Irms	1.924 A	Current	MOSFET RMS ripple current
7.	M2 Irms	6.429 A	Current	MOSFET RMS ripple current
8.	SW Ipk	4.256 A	Current	Peak switch current
9.	BOM Count	26	General	Total Design BOM count
10.	FootPrint	896.0 mm^2	General	Total Foot Print Area of BOM components
11.	Frequency	294.659 kHz	General	Switching frequency
12.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
13.	M1 Rdson	9.8 mOhm	General	Drain-Source On-resistance
14.	M1 ThetaJA	51.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	M2 Rdson	4.3 mOhm	General	Drain-Source On-resistance
16.	M2 ThetaJA	58.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
17.	Pout	36.0 W	General	Total output power
18.	Total BOM	$8.51	General	Total BOM Cost
19.	D1 Tj	52.251 degC	Op_Point	D1 junction temperature
20.	D1 Tj	52.251 degC	Op_Point	D1 junction temperature
21.	D2 Tj	67.8 degC	Op_Point	D1 junction temperature
22.	D3 Tj	52.251 degC	Op_Point	D1 junction temperature
23.	D4 Tj	67.8 degC	Op_Point	D1 junction temperature
24.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
25.	Cross Freq	14.779 kHz	Op_point	Bode plot crossover frequency
26.	Duty Cycle	41.135 %	Op_point	Duty cycle
27.	Efficiency	91.347 %	Op_point	Steady state efficiency
28.	IC Tj	39.962 degC	Op_point	IC junction temperature
29.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
30.	IOUT_OP	3.0 A	Op_point	Iout operating point
31.	M1 TjOP	41.814 degC	Op_point	MOSFET junction temperature
32.	M2 TjOP	41.997 degC	Op_point	MOSFET junction temperature
33.	Phase Marg	48.869 deg	Op_point	Bode Plot Phase Margin
34.	VIN_OP	30.0 V	Op_point	Vin operating point
35.	Vout p-p	28.269 mV	Op_point	Peak-to-peak output ripple voltage
36.	Cin Pd	43.585 mW	Power	Input capacitor power dissipation
37.	Cout Pd	5.788 mW	Power	Output capacitor power dissipation
38.	D1 Pd	494.465 mW	Power	Diode power dissipation
39.	D2 Pd	840.0 mW	Power	Diode power dissipation
40.	D3 Pd	494.465 mW	Power	Diode power dissipation
41.	D4 Pd	840.0 mW	Power	Diode power dissipation
42.	Diode Pd	494.465 mW	Power	Diode power dissipation
43.	IC Pd	249.061 mW	Power	IC power dissipation
44.	L Pd	189.0 mW	Power	Inductor power dissipation
45.	M1 Pd	242.281 mW	Power	MOSFET power dissipation
46.	M1 PdCond	51.005 mW	Power	M1 MOSFET conduction losses
47.	M1 PdSw	191.275 mW	Power	M1 MOSFET switching losses
48.	M2 Pd	21.404 mW	Power	MOSFET power dissipation
49.	M2 PdCond	0.0 W	Power	M2 MOSFET conduction losses
50.	M2 PdSw	21.404 mW	Power	M2 MOSFET switching losses
51.	Total Pd	3.41 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	3.0	Maximum Output Current
2.	Iout1	3.0	Output Current #1
3.	VinMax	30.0	Maximum input voltage
4.	VinMin	8.0	Minimum input voltage
5.	Vout	12.0	Output Voltage
6.	Vout1	12.0	Output Voltage #1
7.	base_pn	LM25118-Q1	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0	Ambient temperature

Design Assistance

1. The LM25118-Q1 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-Q1** Product Folder : http://www.ti.com/product/lm25118%2Dq1 : contains the data sheet and other resources.