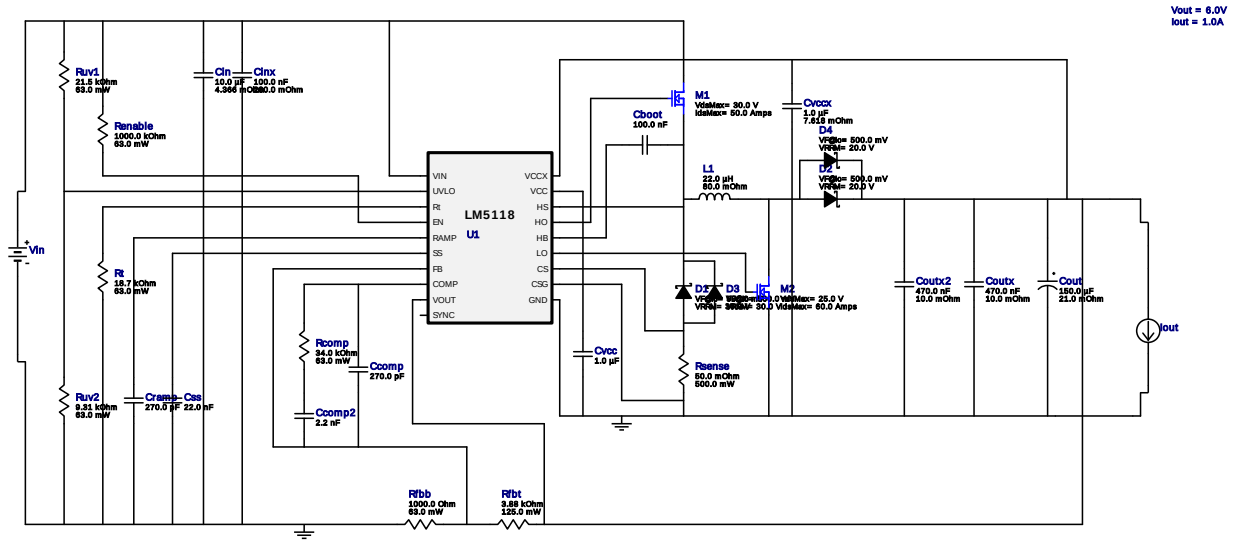
WEBENCH® Design Report

VinMin = 5.0V
VinMax = 20.0V
Vout = 6.0V
Iout = 1.0A

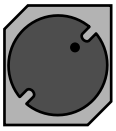
Device = LM5118MH/NOPB
Topology = Buck_Boost
Created = 9/9/16 1:55:05 AM
BOM Cost = $5.10
BOM Count = 28
Total Pd = 0.85W

Design : 1542746/885 LM5118MH/NOPB
LM5118MH/NOPB 5.0V-20.0V to 6.00V @ 1.0A

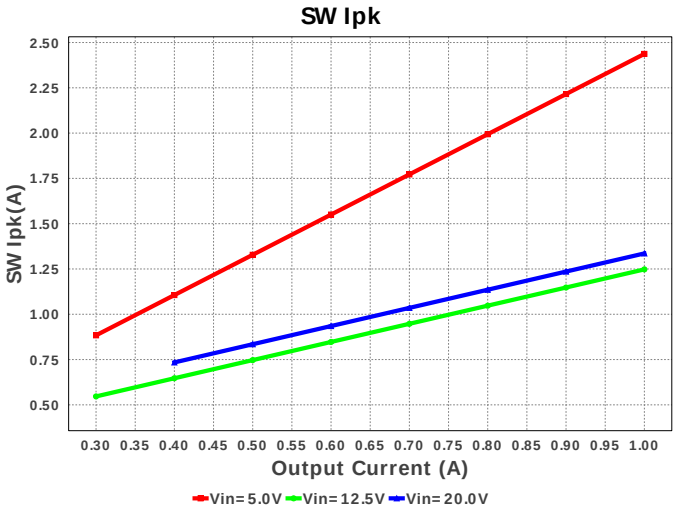


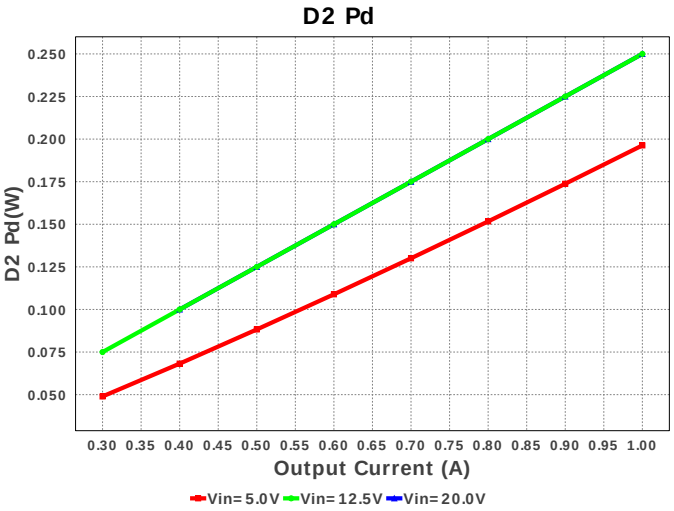
Electrical BOM

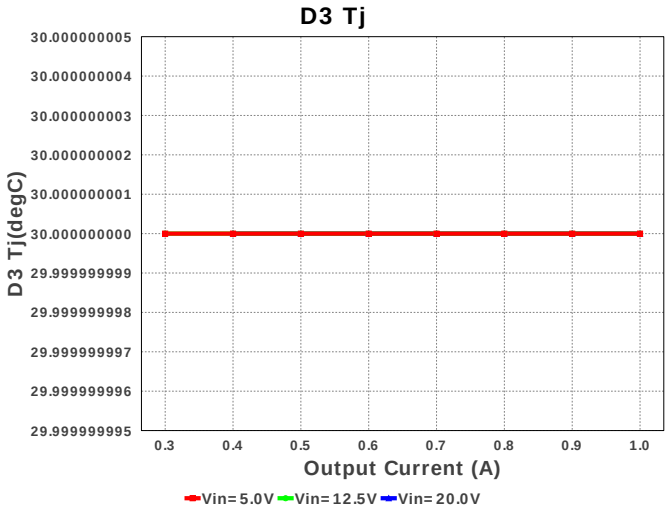
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	Samsung Electro-Mechanics	CL21C271JBANFNC Series= C0G/NP0	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	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	GRM31CR71E106KA12L Series= X7R	Cap= 10.0 uF ESR= 4.366 mOhm VDC= 25.0 V IRMS= 2.8022 A	1	$0.05	1206_190 11 mm²
5.	Cinx	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
6.	Cout	Chemi-Con	APXE100ARA151MF80G Series= PXE	Cap= 150.0 uF ESR= 21.0 mOhm VDC= 10.0 V IRMS= 2.88 A	1	$0.53	CAPSMT_62_F80 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	Samsung Electro-Mechanics	CL21C271JBANFNC Series= C0G/NP0	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²

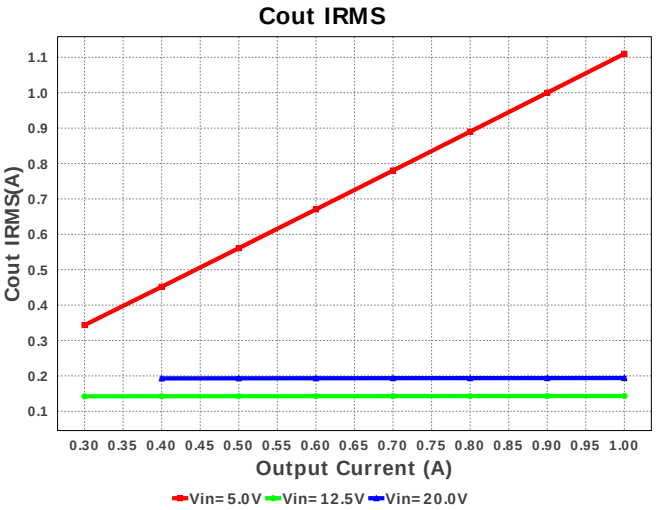
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Css	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
11.	Cvcc	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0805 7 mm²
12.	Cvccx	TDK	C1005X5R0J105M 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.	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	SDR1105-220ML	L= 22.0 µH DCR= 80.0 mOhm	1	$0.29	 SDR1105 157 mm²
18.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	$0.28	 DQG0008A 18 mm²
19.	M2	Texas Instruments	CSD16323Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.41	 DQG0008A 18 mm²
20.	Rcomp	Vishay-Dale	CRCW040234K0FKED Series= CRCW..e3	Res= 34.0 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	RT0805BRD073K88L Series= RT0805	Res= 3.88 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	 0805 7 mm²
24.	Rsense	Stackpole Electronics Inc	CSR1206FK50L0 Series= ?	Res= 50.0 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	CRCW040221K5FKED Series= CRCW..e3	Res= 21.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
27.	Ruv2	Vishay-Dale	CRCW04029K31FKED Series= CRCW..e3	Res= 9.31 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

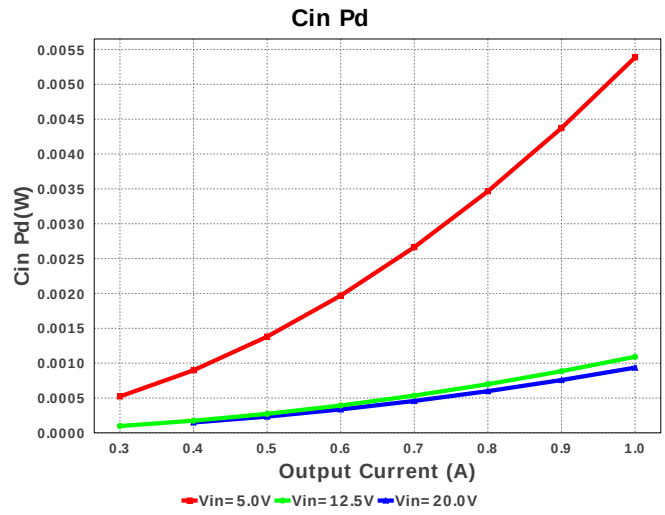
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	U1	Texas Instruments	LM5118MH/NOPB	Switcher	1	$2.86	 MXA20A 71 mm²

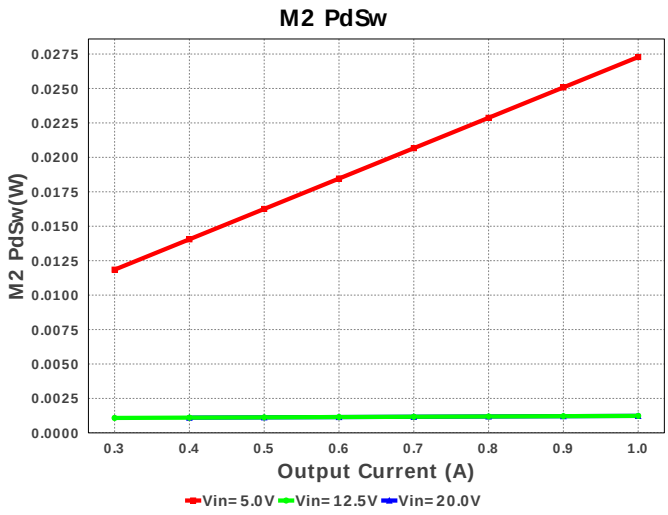


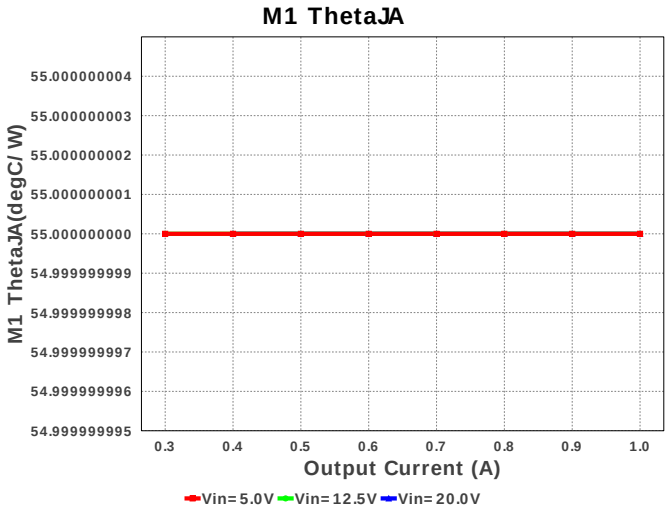


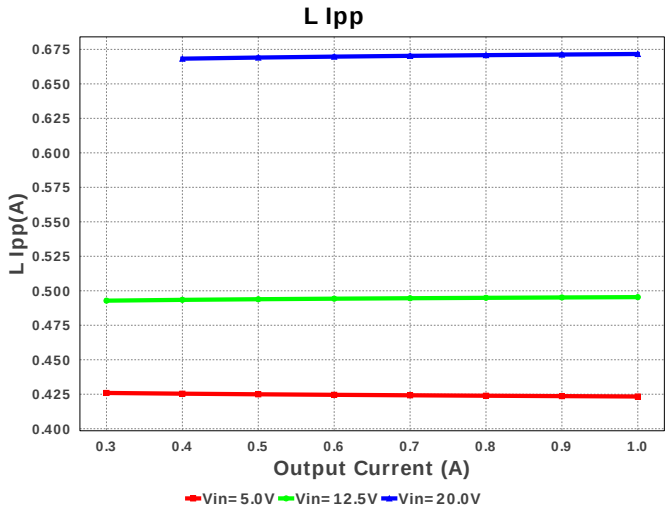


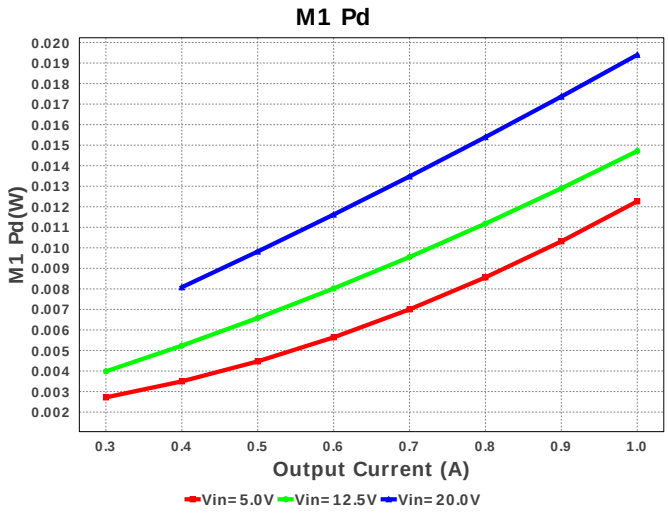


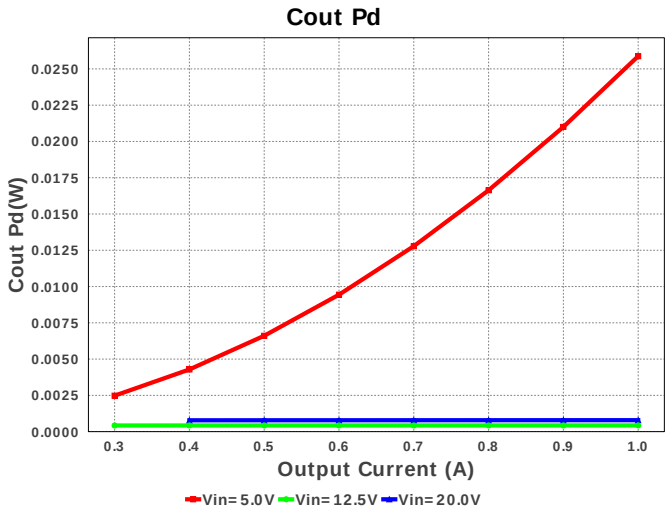


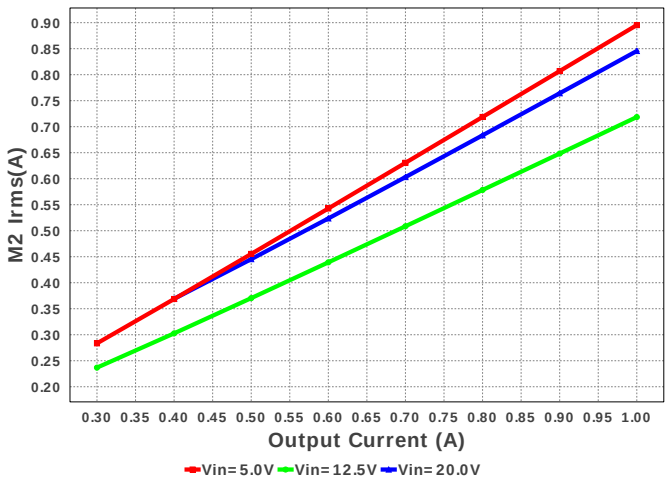


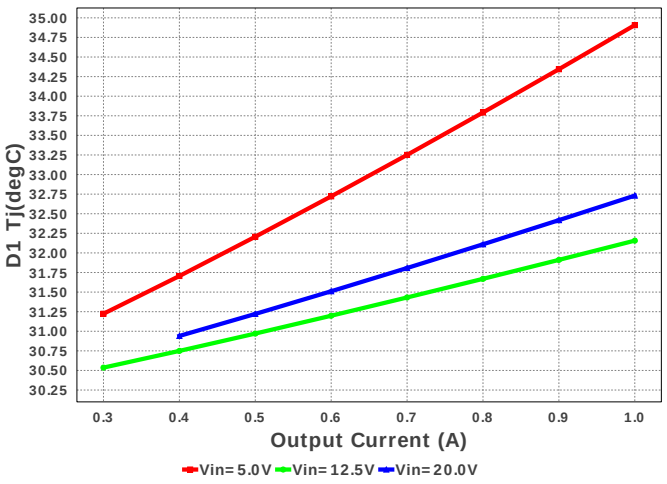


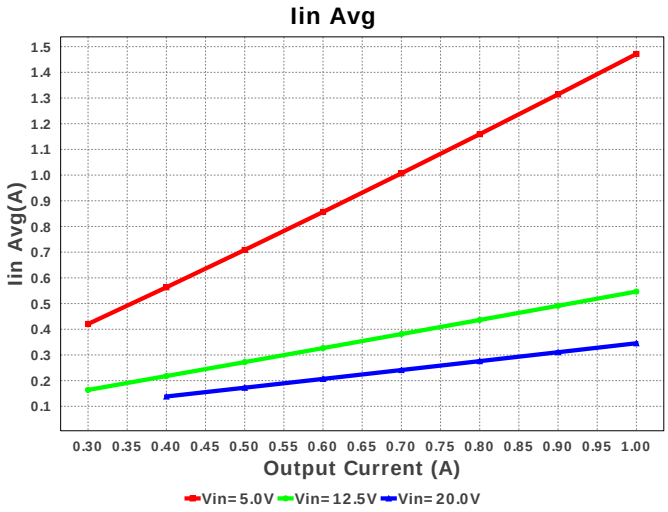


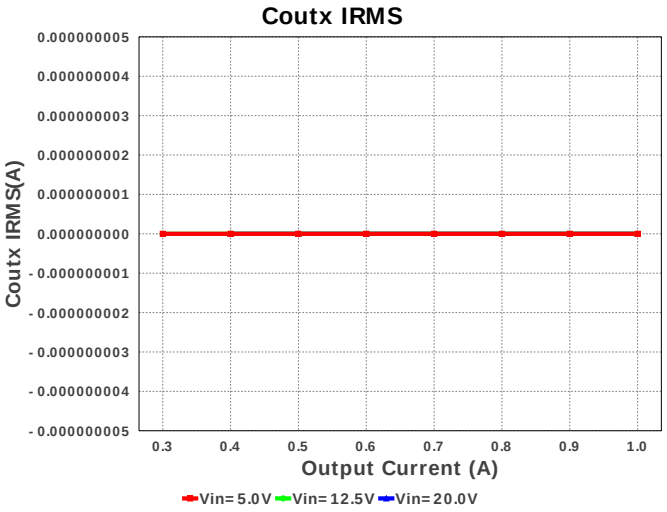


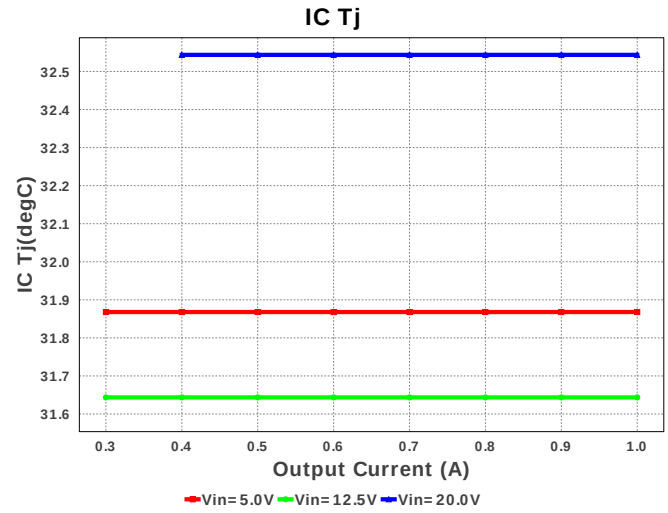


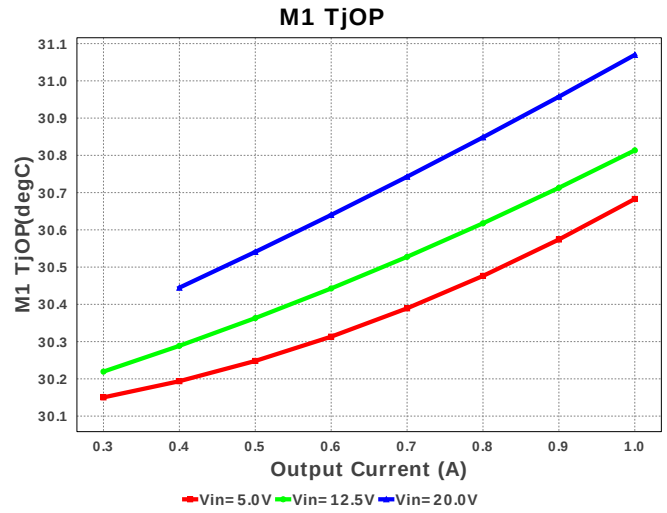


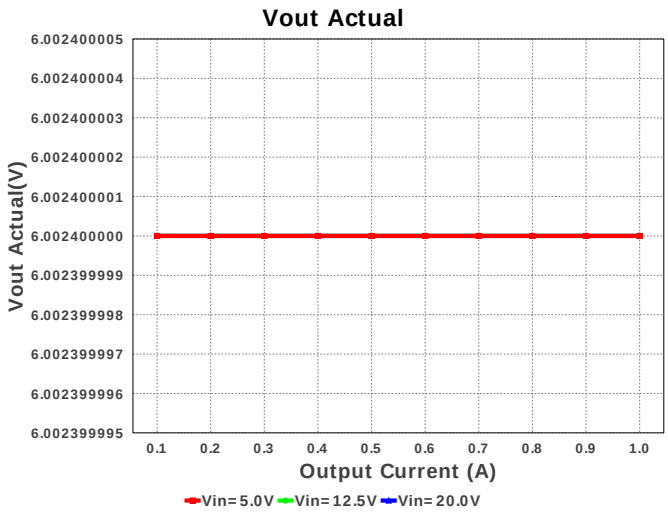


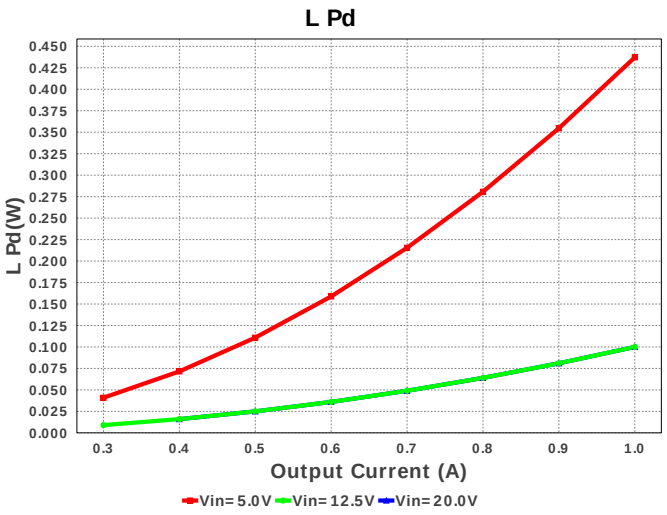


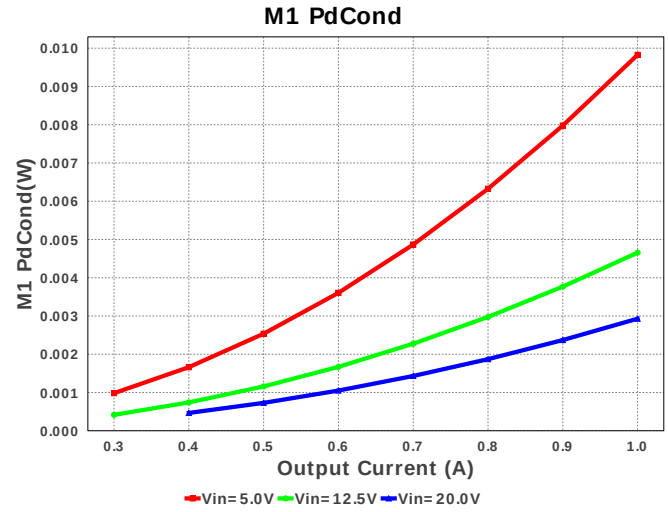


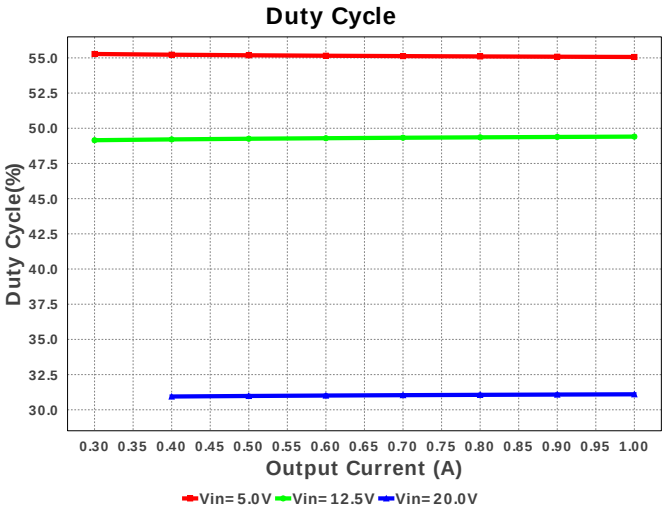


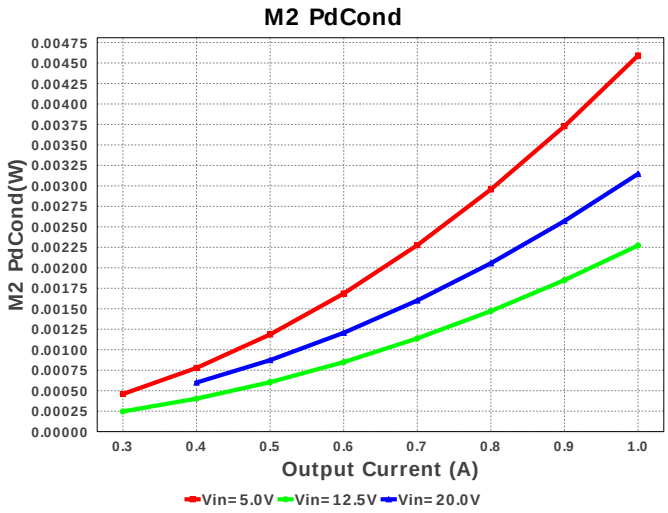


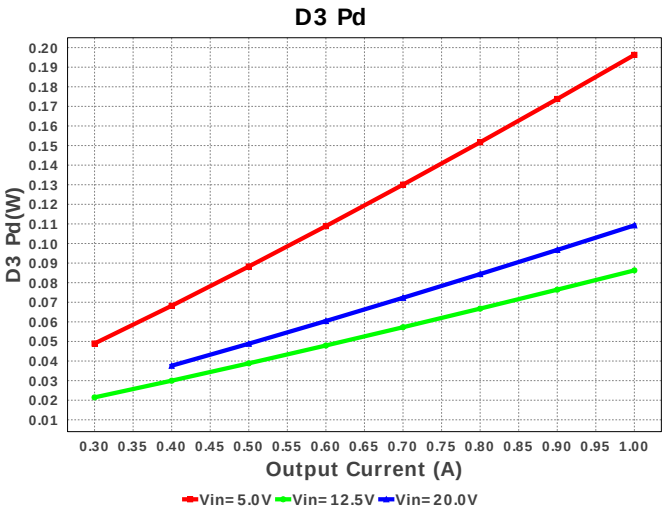


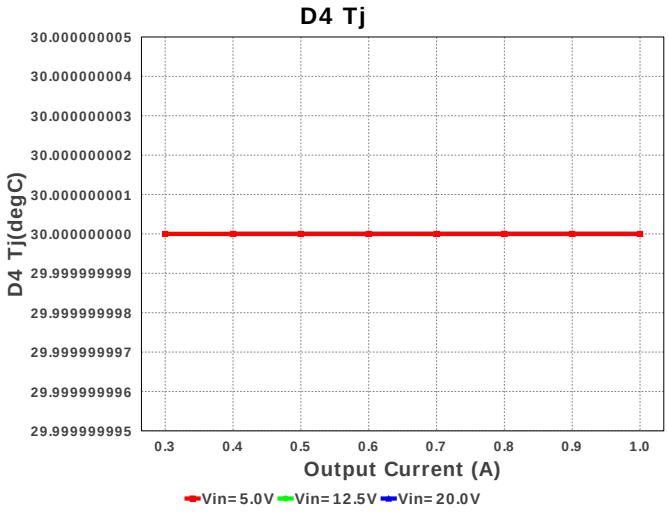


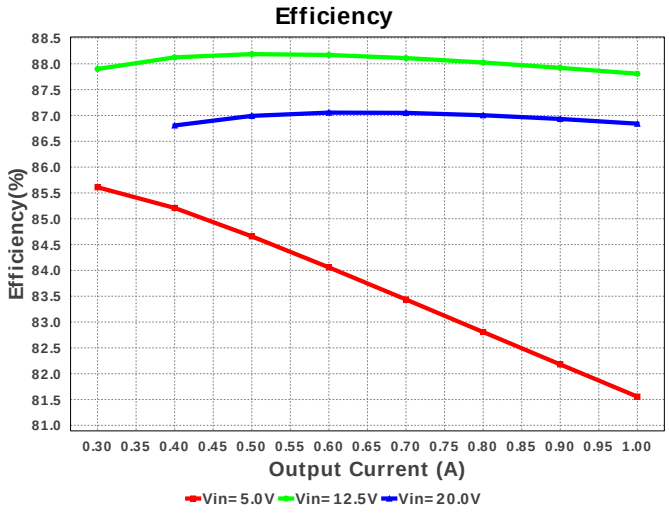


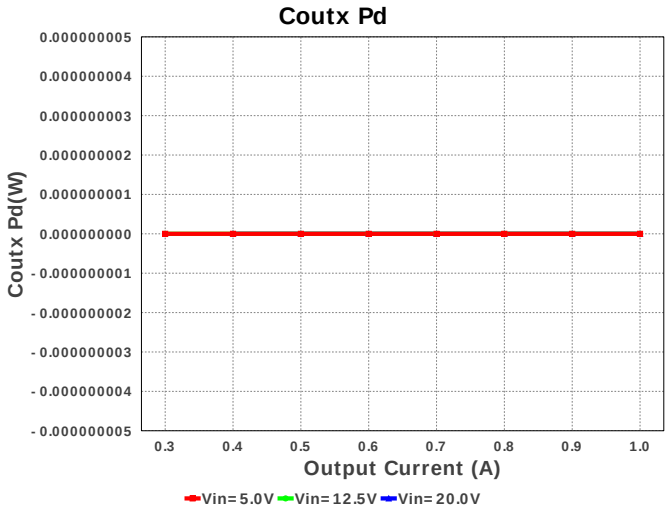


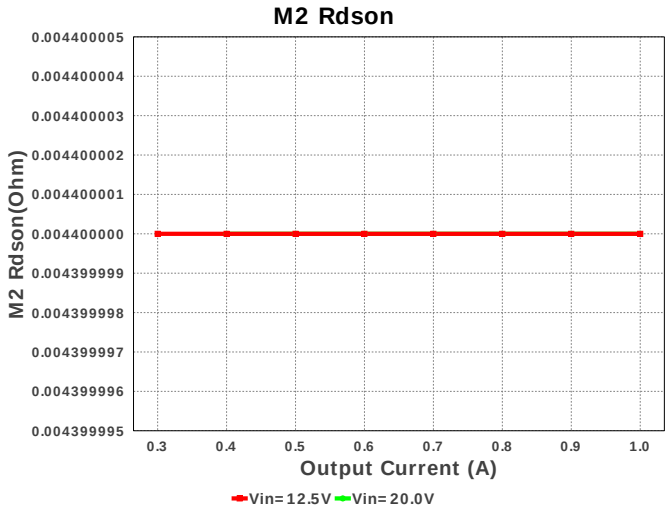


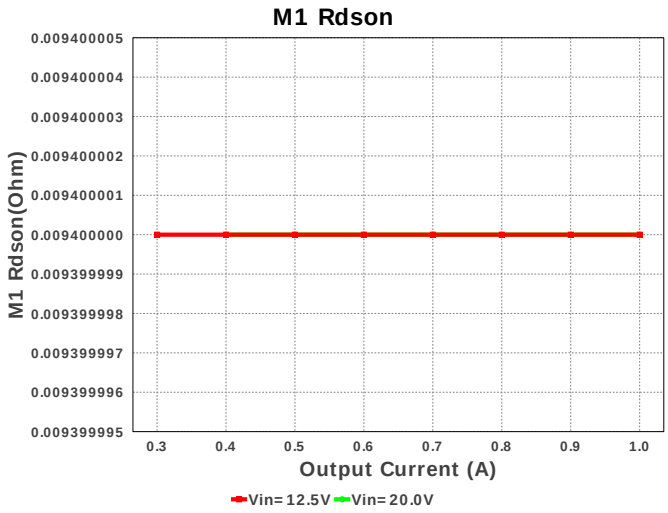


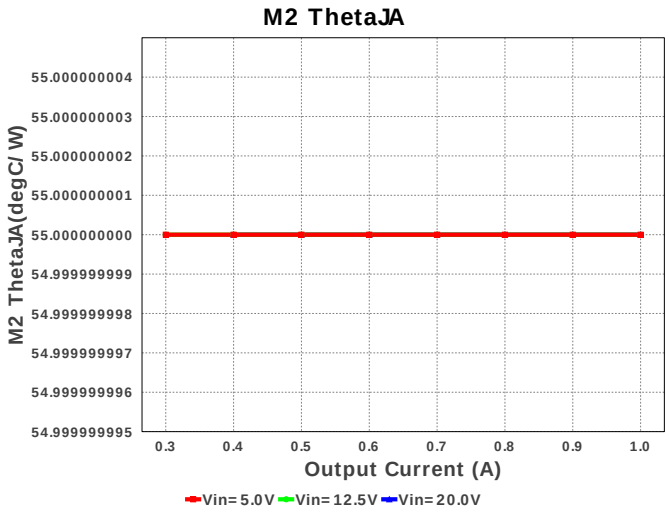


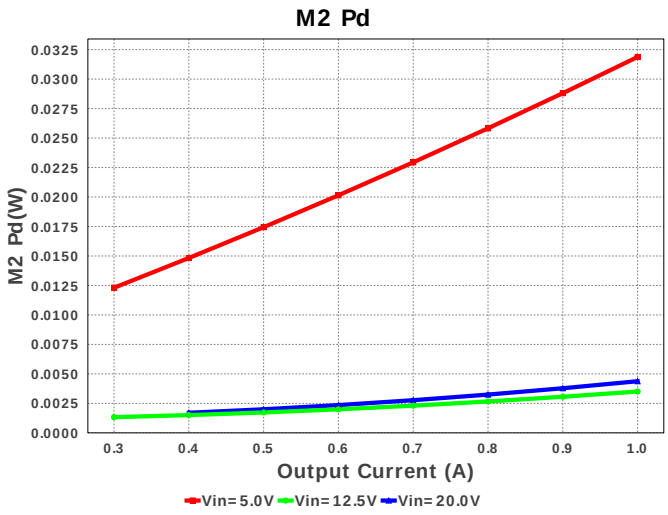


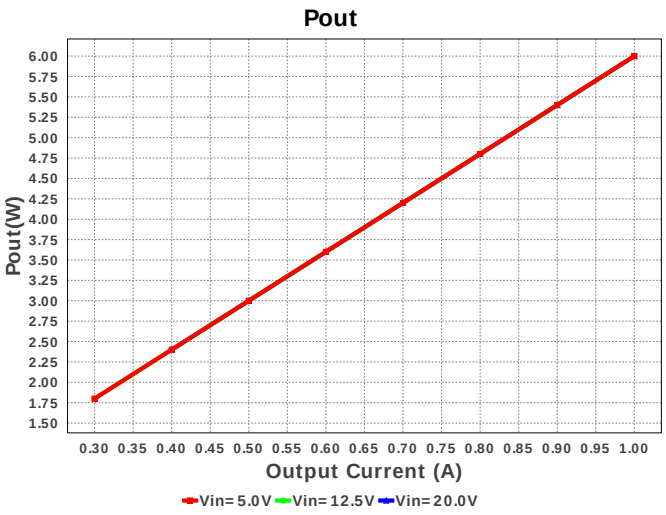


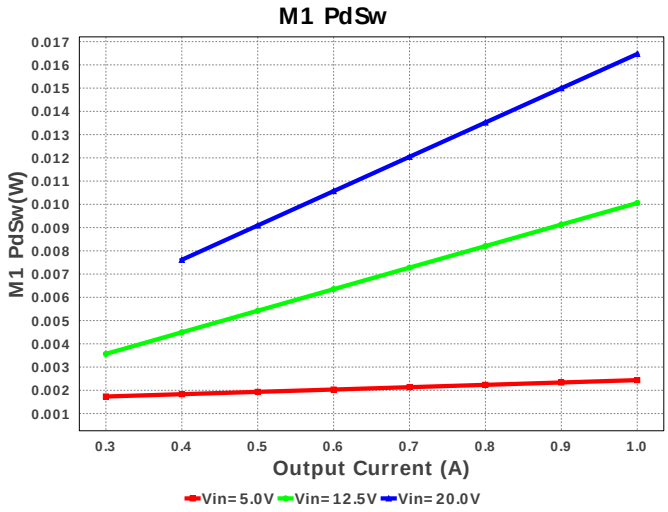


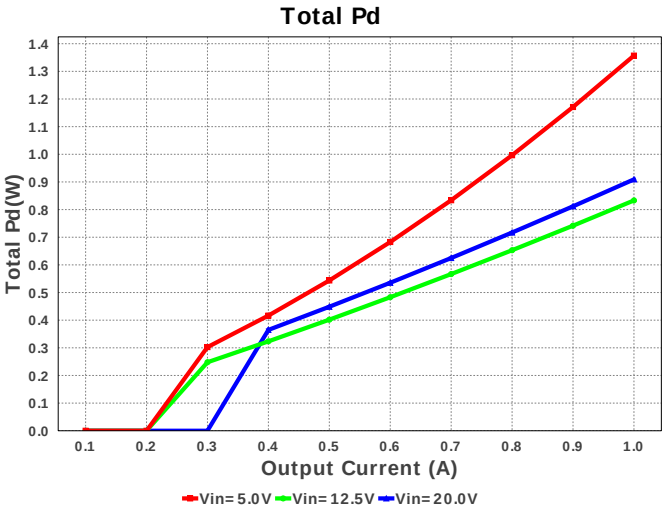


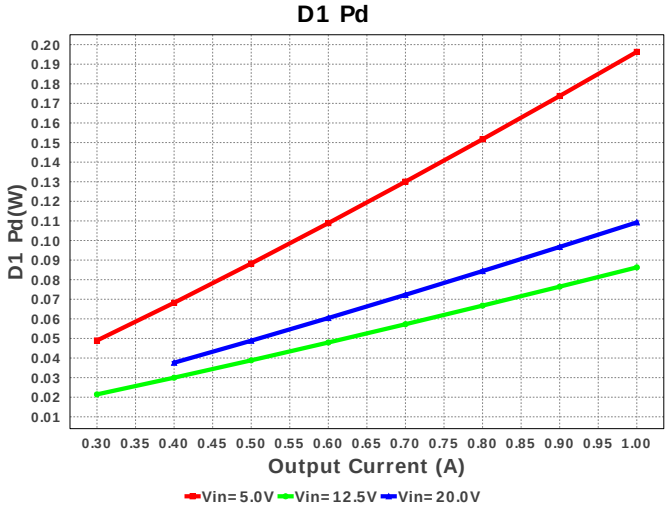


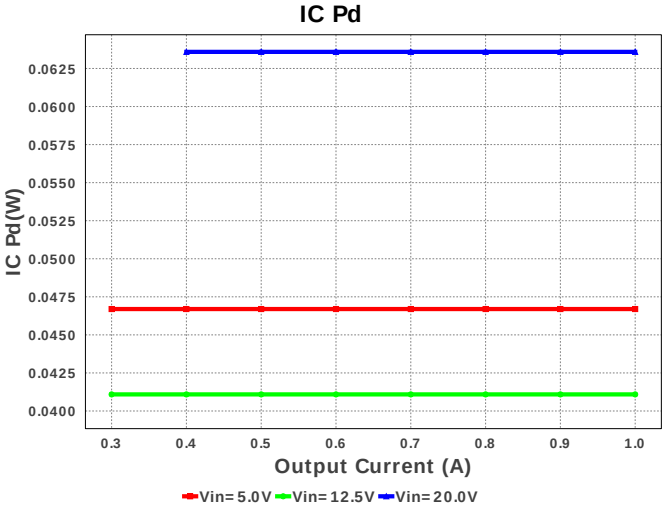


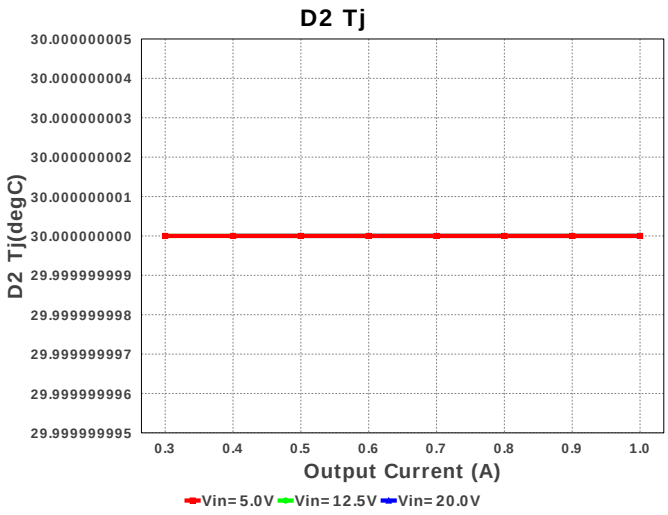


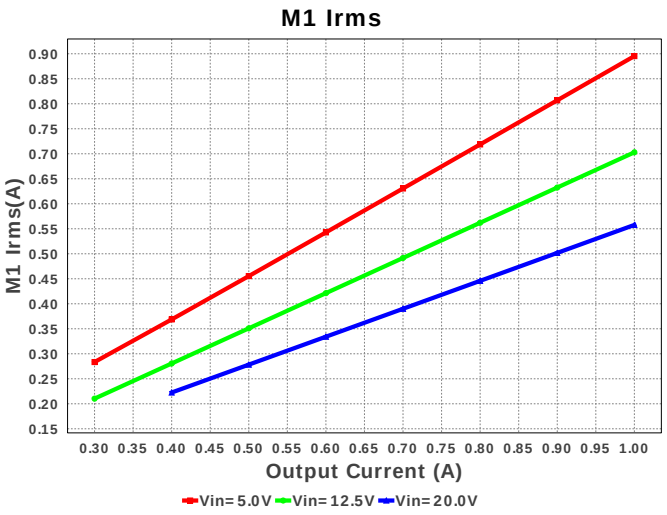


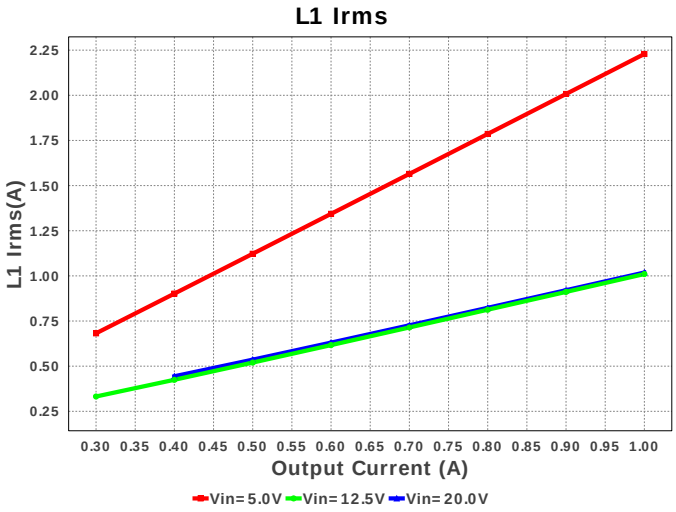


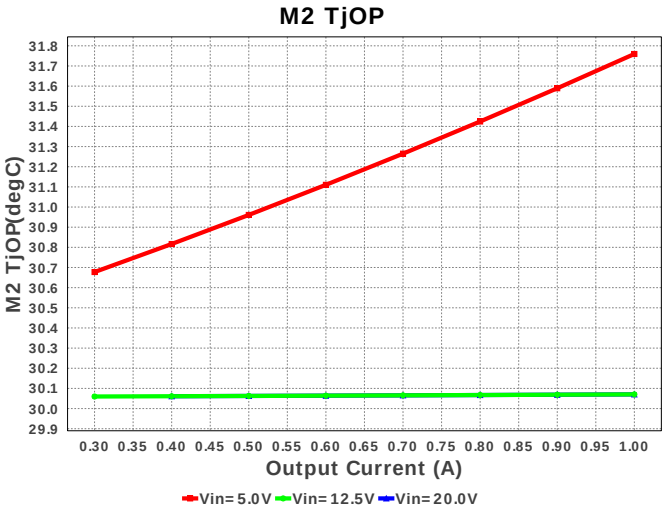


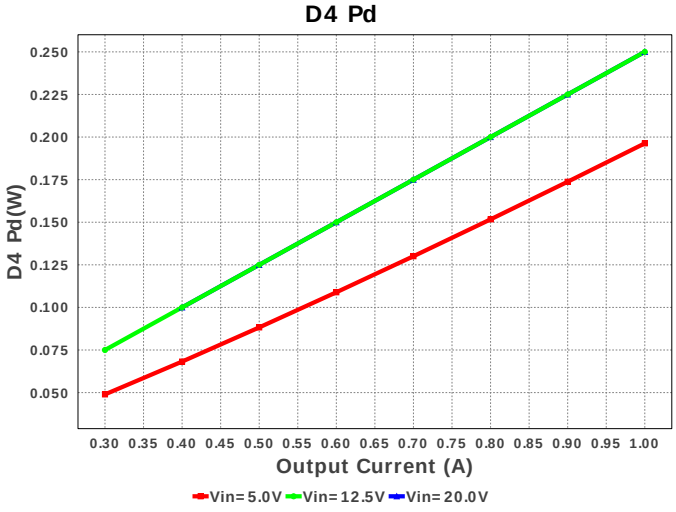


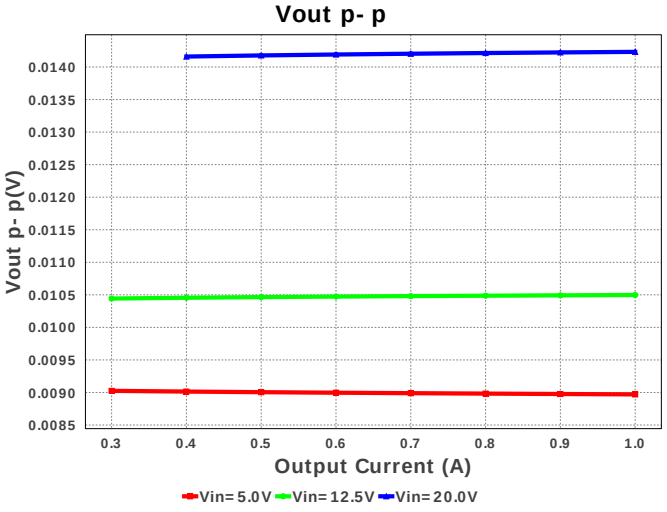


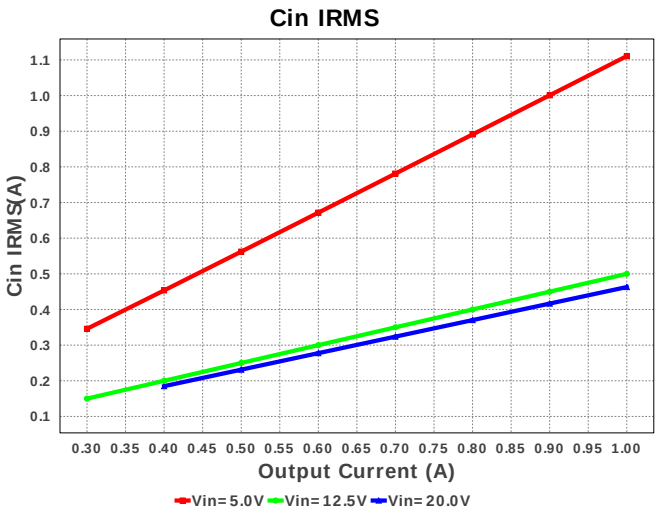


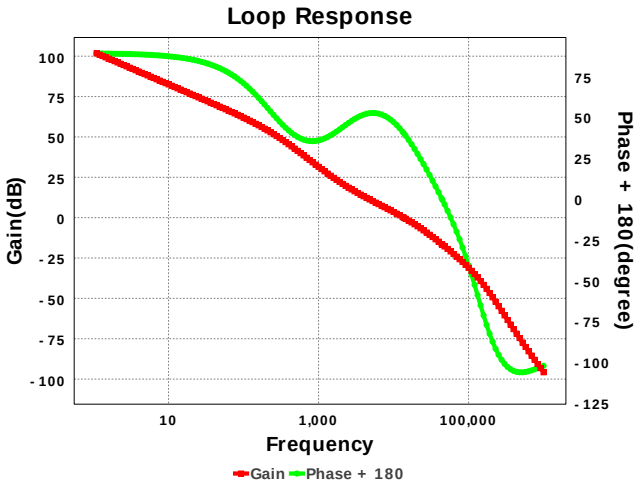












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	463.939 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	195.485 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	342.64 mA	Current	Average input current
5.	L Ipp	677.18 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	1.019 A	Current	Inductor ripple current
7.	M1 Irms	559.963 mA	Current	MOSFET RMS ripple current
8.	M2 Irms	844.2 mA	Current	MOSFET RMS ripple current
9.	SW Ipk	1.339 A	Current	Peak switch current
10.	BOM Count	28	General	Total Design BOM count
11.	FootPrint	609.0 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.	Mode	CCM	General	Conduction Mode
19.	Pout	6.0 W	General	Total output power
20.	Total BOM	$5.1	General	Total BOM Cost
21.	D1 Tj	33.369 degC	Op_Point	D1 junction temperature
22.	D2 Tj	34.907 degC	Op_Point	D2 junction temperature
23.	D3 Tj	33.369 degC	Op_Point	D3 junction temperature
24.	D4 Tj	34.907 degC	Op_Point	D4 junction temperature
25.	Low Freq Gain	101.72 dB	Op_Point	Gain at 10Hz
26.	Vout Actual	6.002 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
27.	Vout OP	6.0 V	Op_Point	Operational Output Voltage
28.	Cross Freq	13.65 kHz	Op_point	Bode plot crossover frequency
29.	Duty Cycle	31.356 %	Op_point	Duty cycle
30.	Efficiency	87.556 %	Op_point	Steady state efficiency
31.	Gain Marg	-16.796 dB	Op_point	Bode Plot Gain Margin
32.	IC Tj	32.544 degC	Op_point	IC junction temperature
33.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
34.	IOUT_OP	1.0 A	Op_point	Iout operating point
35.	M1 TjOP	31.072 degC	Op_point	MOSFET junction temperature
36.	M2 TjOP	30.988 degC	Op_point	MOSFET junction temperature
37.	Operating Topology	Buck	Op_point	The current operating topology of the device
38.	Phase Marg	40.96 deg	Op_point	Bode Plot Phase Margin
39.	VIN_OP	20.0 V	Op_point	Vin operating point
40.	Vout p-p	14.349 mV	Op_point	Peak-to-peak output ripple voltage
41.	Cin Pd	939.735 µW	Power	Input capacitor power dissipation
42.	Cout Pd	802.499 µW	Power	Output capacitor power dissipation
43.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
44.	D1 Pd	134.745 mW	Power	Diode power dissipation
45.	D2 Pd	196.294 mW	Power	Diode2 power dissipation
46.	D3 Pd	134.745 mW	Power	Diode3 power dissipation
47.	D4 Pd	196.294 mW	Power	Diode4 power dissipation
48.	IC Pd	63.591 mW	Power	IC power dissipation
49.	L Pd	100.0 mW	Power	Inductor power dissipation
50.	M1 Pd	19.467 mW	Power	MOSFET power dissipation
51.	M1 PdCond	2.986 mW	Power	M1 MOSFET conduction losses
52.	M1 PdSw	16.481 mW	Power	M1 MOSFET switching losses

#	Name	Value	Category	Description
53.	M2 Pd	7.884 mW	Power	MOSFET power dissipation
54.	M2 PdCond	3.148 mW	Power	M2 MOSFET conduction losses
55.	M2 PdSw	4.737 mW	Power	M2 MOSFET switching losses
56.	Total Pd	852.762 mW	Power	Total Power Dissipation
57.	Vout Tolerance	2.36 %		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	20.0	Maximum input voltage
3.	VinMin	5.0	Minimum input voltage
4.	Vout	6.0	Output Voltage
5.	base_pn	LM5118	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

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.