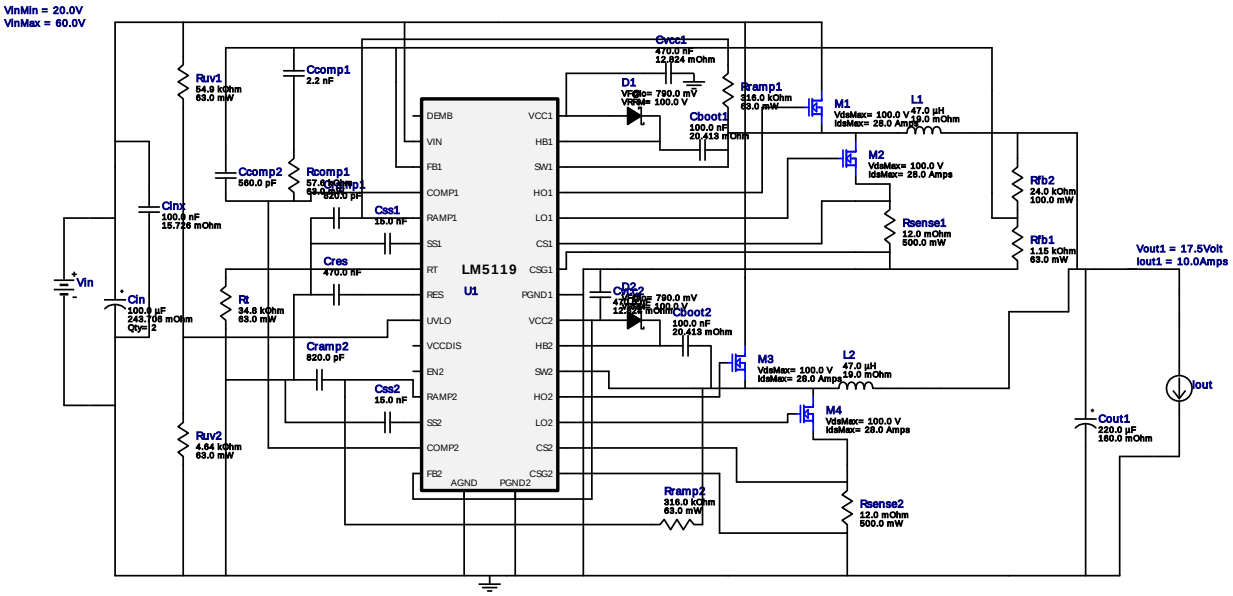
WEBENCH® Design Report

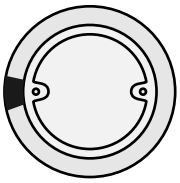
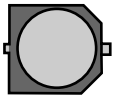
VinMin = 20.0V
VinMax = 60.0V
Vout = 17.5V
Iout = 10.0A

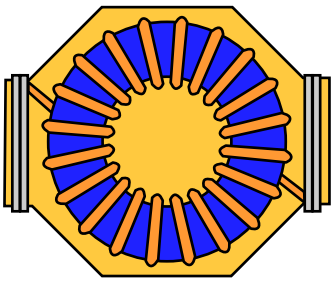
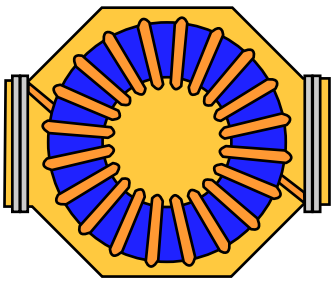
Device = LM5119PSQ/NOPB
Topology = Buck
Created = 5/10/14 6:55:36 AM
BOM Cost = $10.13
Footprint = 2,869.0mm2
BOM Count = 34
Total Pd = 6.79W

Design : 3754495/82 LM5119PSQ/NOPB
LM5119PSQ/NOPB 20.0V-60.0V to 17.5V @ 10.0A

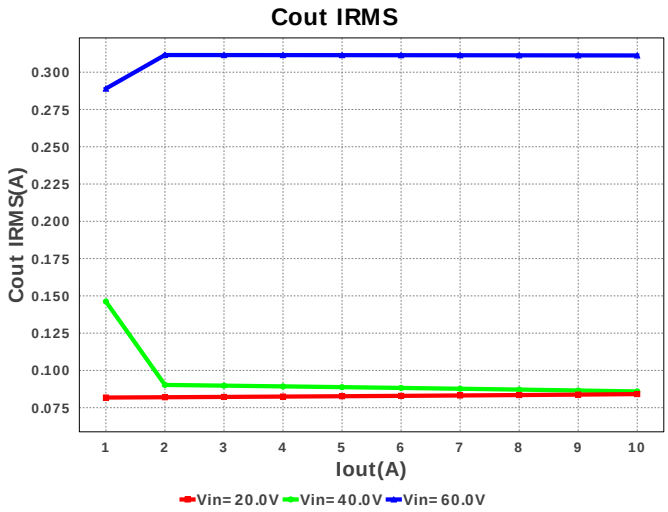


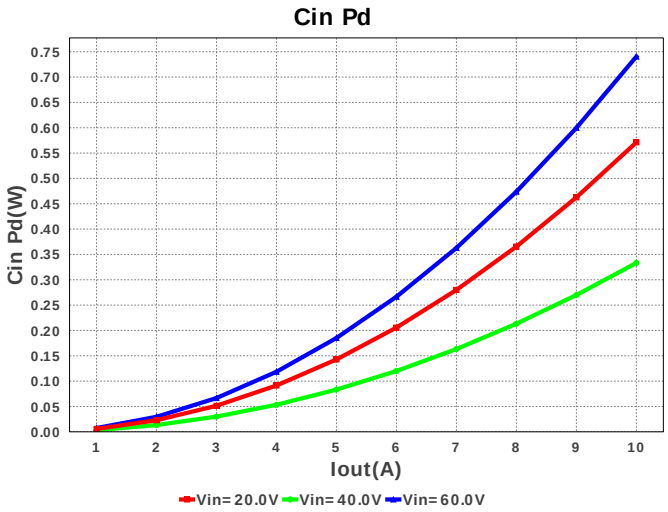
Electrical BOM

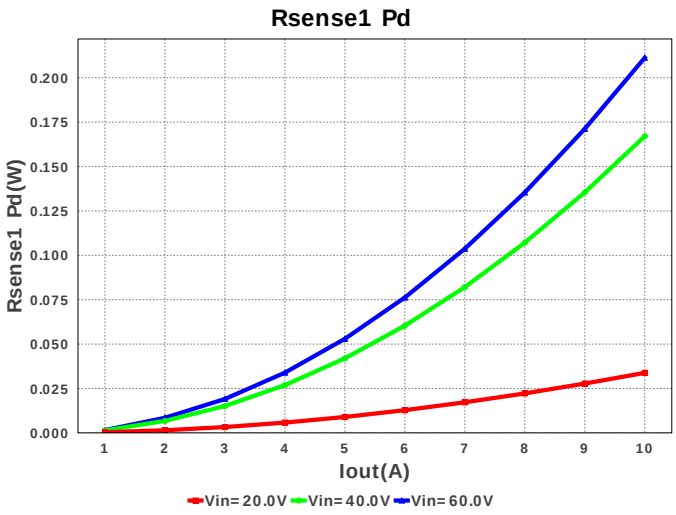
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot1	TDK	C1005X5R1A104K Series= 285	Cap= 100.0 nF ESR= 20.413 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	1005 3mm2
2.	Cboot2	TDK	C1005X5R1A104K Series= 285	Cap= 100.0 nF ESR= 20.413 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	1005 3mm2
3.	Ccomp1	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
4.	Ccomp2	Yageo America	CC0805KRX7R9BB561 Series= X7R	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
5.	Cin	Panasonic	EEUED2D101 Series= 286	Cap= 100.0 µF ESR= 243.706 mOhm VDC= 200.0 V IRMS= 1.3 A	2	$0.51	 CAPPR7.5-16X25 324mm2
6.	Cinx	TDK	C2012X7R2A104K Series= 285	Cap= 100.0 nF ESR= 15.726 mOhm VDC= 100.0 V IRMS= 0.0 A	1	$0.03	0805 7mm2
7.	Cout1	Panasonic	EEE-FK1E221P Series= FK	Cap= 220.0 µF ESR= 160.0 mOhm VDC= 25.0 V IRMS= 600.0 mA	1	$0.24	 SM_RADIAL_F 124mm2

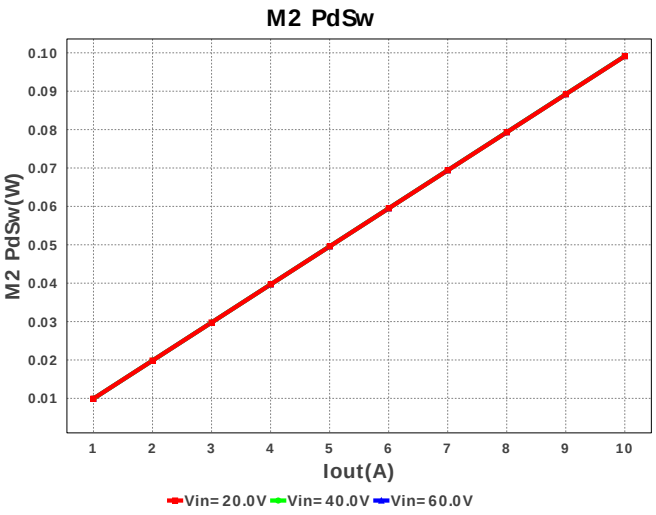
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Cramp1	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7mm2
9.	Cramp2	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7mm2
10.	Cres	MuRata	GRM155C80G474KE01D Series= 379	Cap= 470.0 nF VDC= 4.0 V IRMS= 0.0 A	1	$0.01	 0402 3mm2
11.	Css1	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7mm2
12.	Css2	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7mm2
13.	Cvcc1	TDK	C1608X5R1A474K Series= 285	Cap= 470.0 nF ESR= 12.824 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 1608 5mm2
14.	Cvcc2	TDK	C1608X5R1A474K Series= 285	Cap= 470.0 nF ESR= 12.824 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 1608 5mm2
15.	D1	Diodes Inc.	B1100-13-F	VF@Io= 790.0 mV VRRM= 100.0 V	1	$0.10	 SMA 37mm2
16.	D2	Diodes Inc.	B1100-13-F	VF@Io= 790.0 mV VRRM= 100.0 V	1	$0.10	 SMA 37mm2
17.	L1	Bourns	PM2120-470K-RC	L= 47.0 µH DCR= 19.0 mOhm	1	$1.33	 PM2120 890mm2
18.	L2	Bourns	PM2120-470K-RC	L= 47.0 µH DCR= 19.0 mOhm	1	$1.33	 PM2120 890mm2
19.	M1	Infineon Technologies	BSZ160N10NS3 G	VdsMax= 100.0 V IdsMax= 28.0 Amps	1	$0.58	 PG-TSDSON-8 19mm2
20.	M2	Infineon Technologies	BSZ160N10NS3 G	VdsMax= 100.0 V IdsMax= 28.0 Amps	1	$0.58	 PG-TSDSON-8 19mm2
21.	M3	Infineon Technologies	BSZ160N10NS3 G	VdsMax= 100.0 V IdsMax= 28.0 Amps	1	$0.58	 PG-TSDSON-8 19mm2
22.	M4	Infineon Technologies	BSZ160N10NS3 G	VdsMax= 100.0 V IdsMax= 28.0 Amps	1	$0.58	 PG-TSDSON-8 19mm2

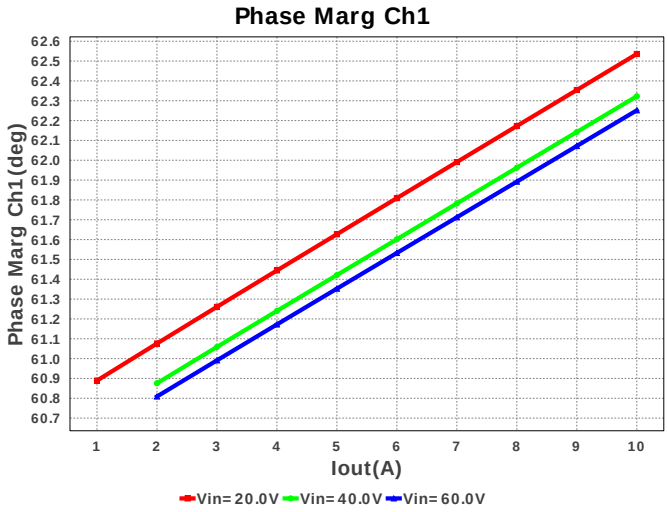
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
23.	Rcomp1	Vishay-Dale	CRCW040257K6FKED Series= CRCW..e3	Res= 57.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
24.	Rfb1	Vishay-Dale	CRCW04021K15FKED Series= CRCW..e3	Res= 1.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
25.	Rfb2	Susumu Co Ltd	RR1220P-243-D Series= 264	Res= 24.0 kOhm Power= 100.0 mW Tolerance= 0.5%	1	$0.01	0805 7mm2
26.	Rramp1	Vishay-Dale	CRCW0402316KFKED Series= CRCW..e3	Res= 316.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
27.	Rramp2	Vishay-Dale	CRCW0402316KFKED Series= CRCW..e3	Res= 316.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
28.	Rsense1	Stackpole Electronics Inc	CSR1206FK12L0 Series= ?	Res= 12.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	1206 11mm2
29.	Rsense2	Stackpole Electronics Inc	CSR1206FK12L0 Series= ?	Res= 12.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	1206 11mm2
30.	Rt	Vishay-Dale	CRCW040234K8FKED Series= CRCW..e3	Res= 34.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
31.	Ruv1	Vishay-Dale	CRCW040254K9FKED Series= CRCW..e3	Res= 54.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
32.	Ruv2	Vishay-Dale	CRCW04024K64FKED Series= CRCW..e3	Res= 4.64 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
33.	U1	Texas Instruments	LM5119PSQ/NOPB	Switcher	1	$3.25	SQA32A 49mm2

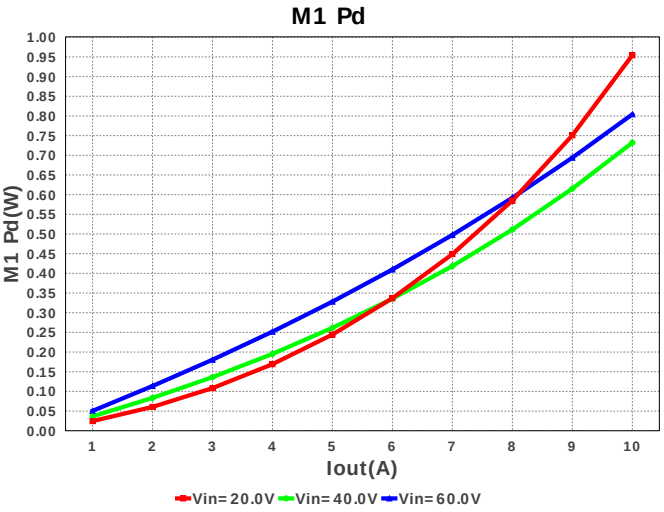


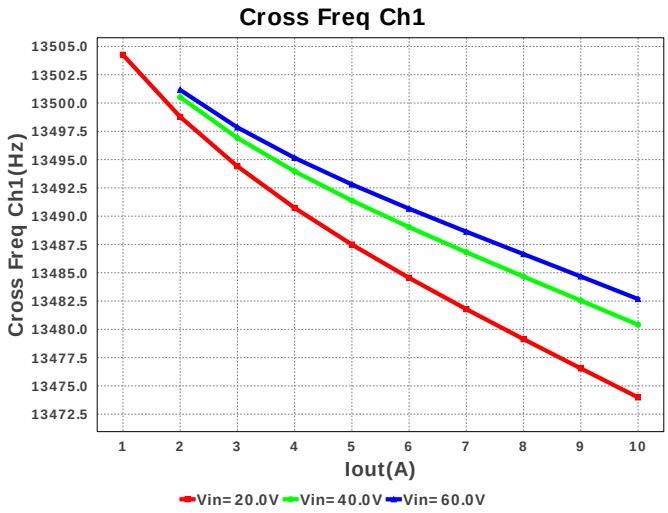


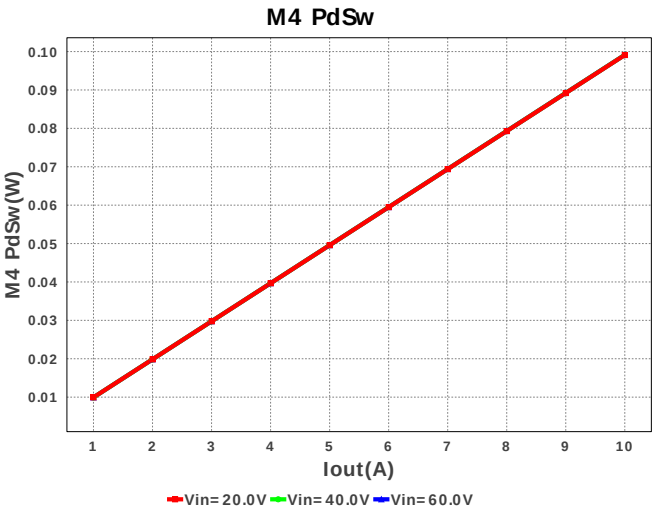


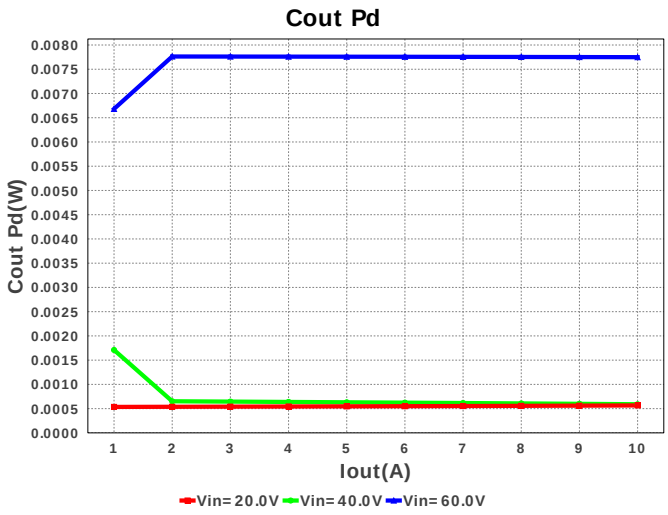


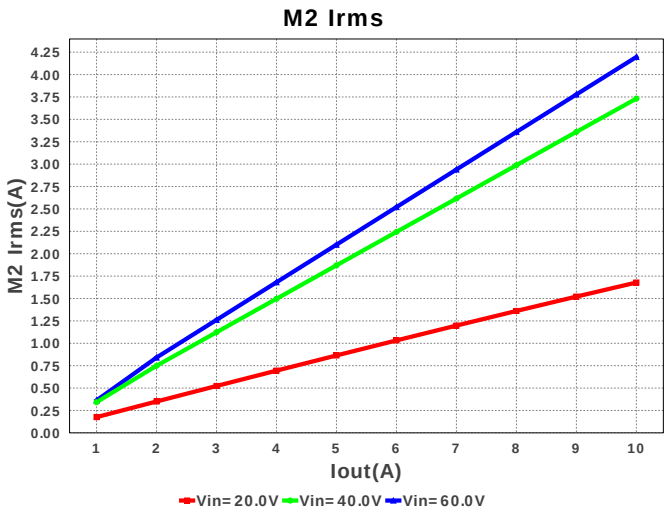


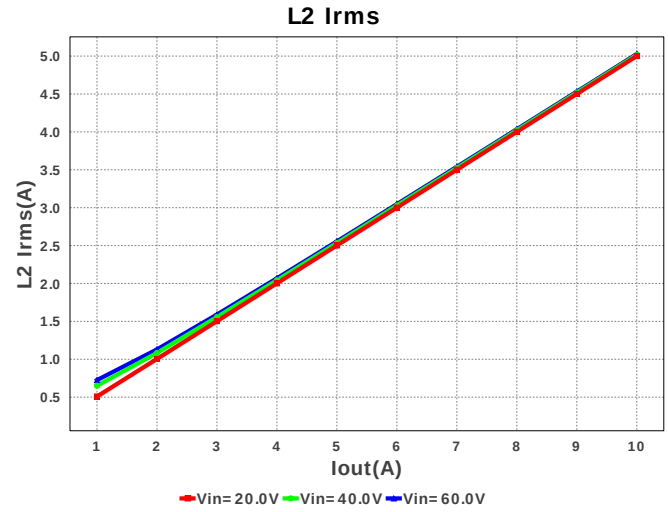


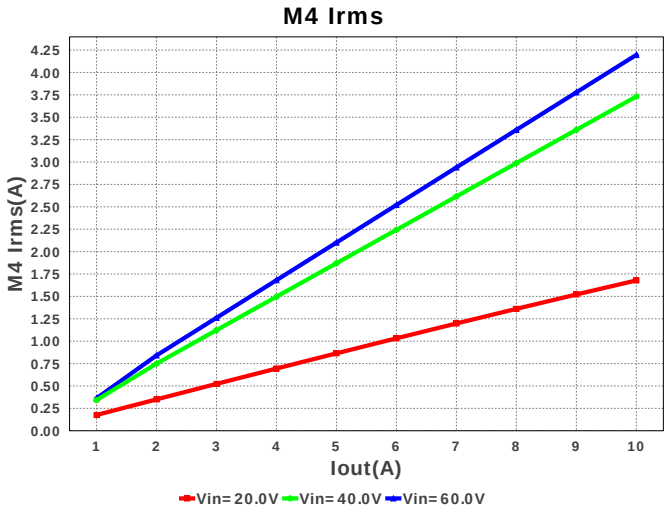


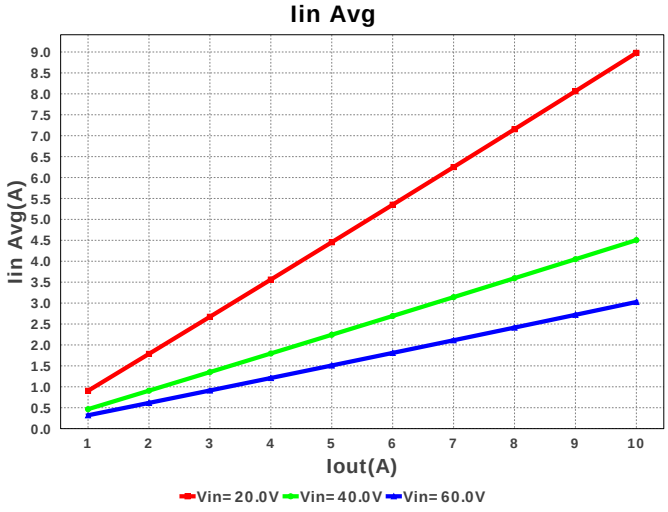


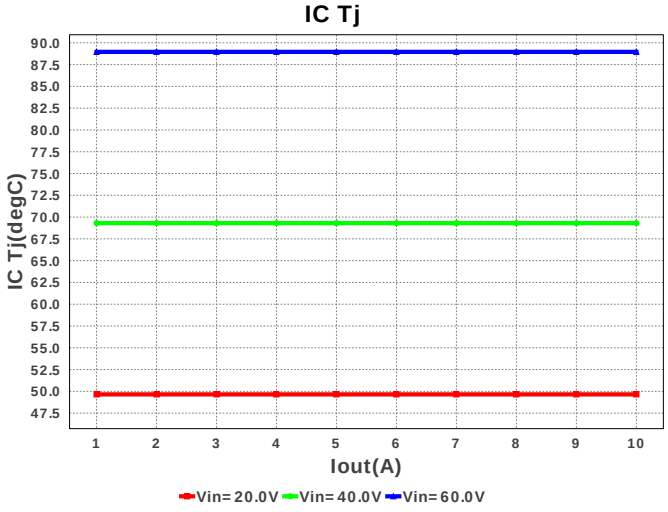


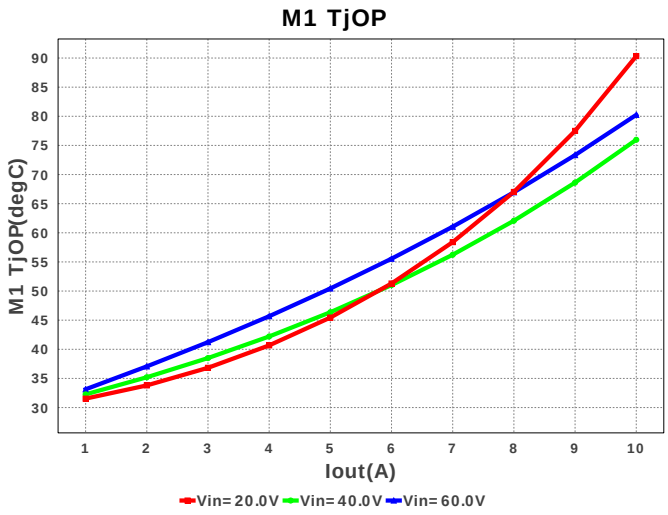


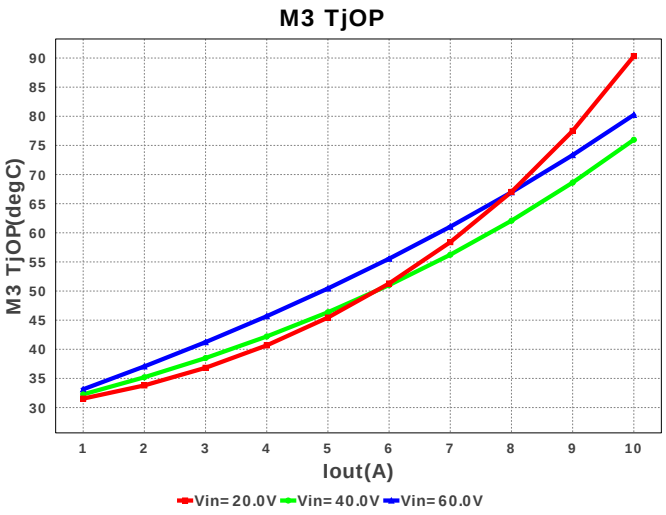


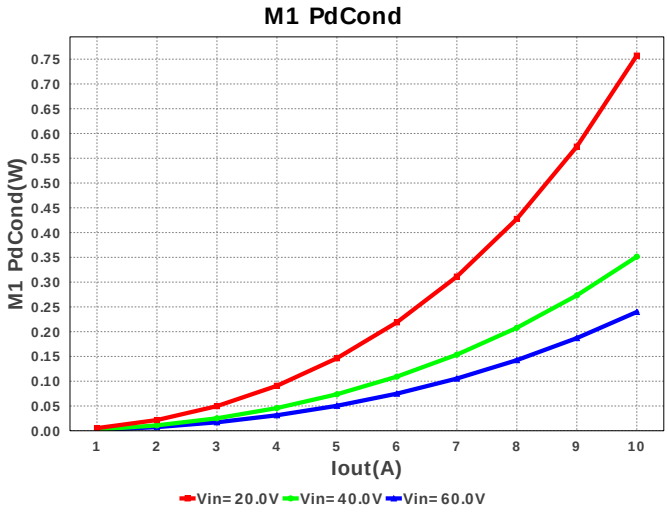


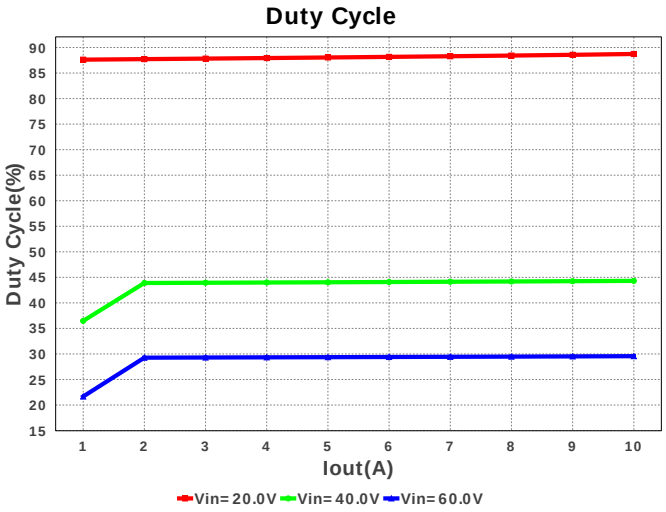


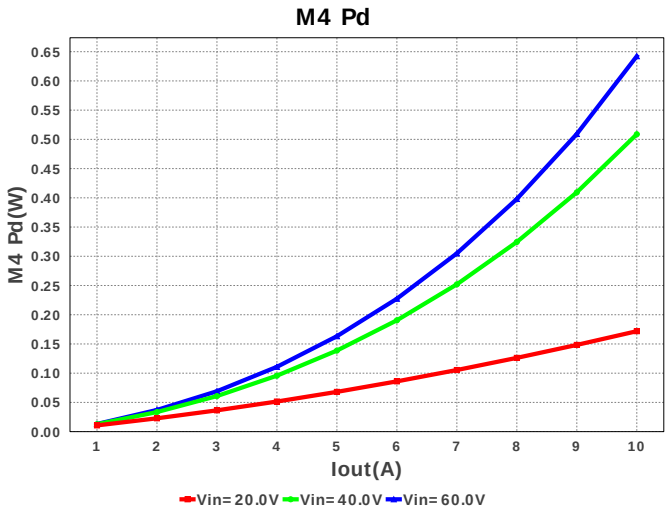


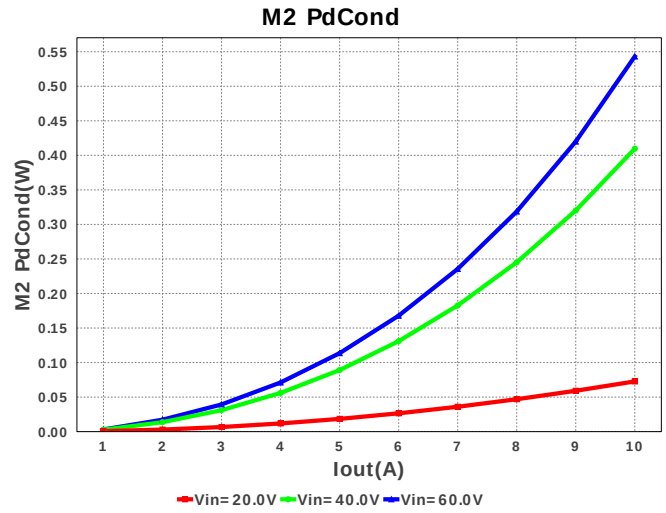


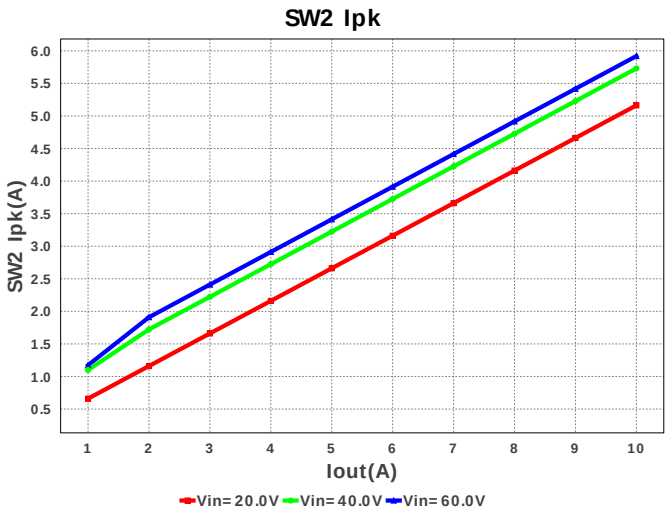


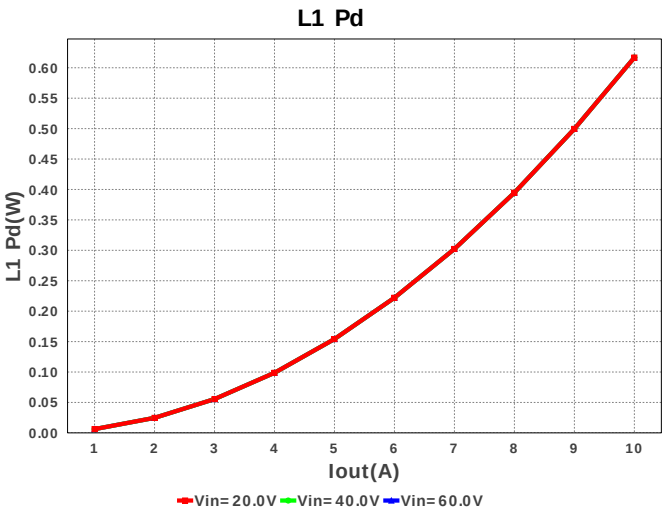


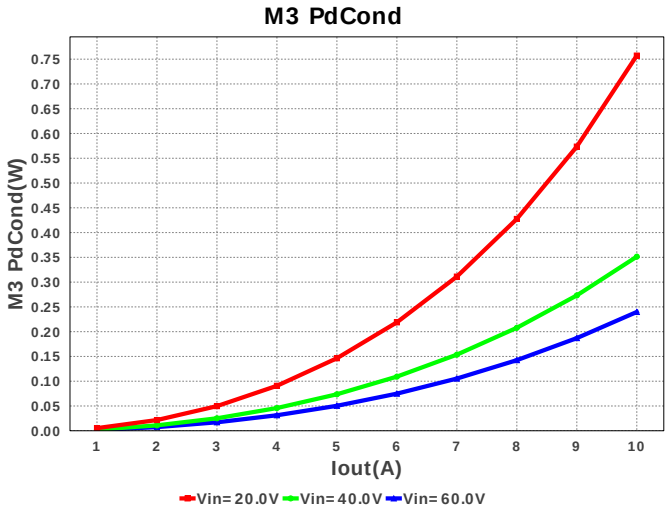


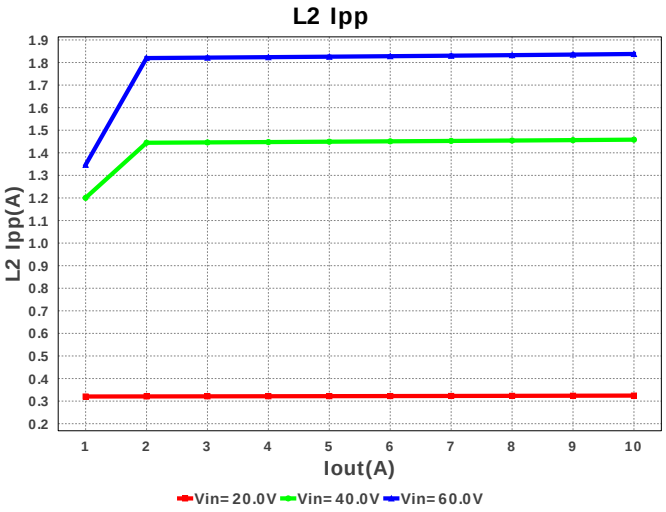


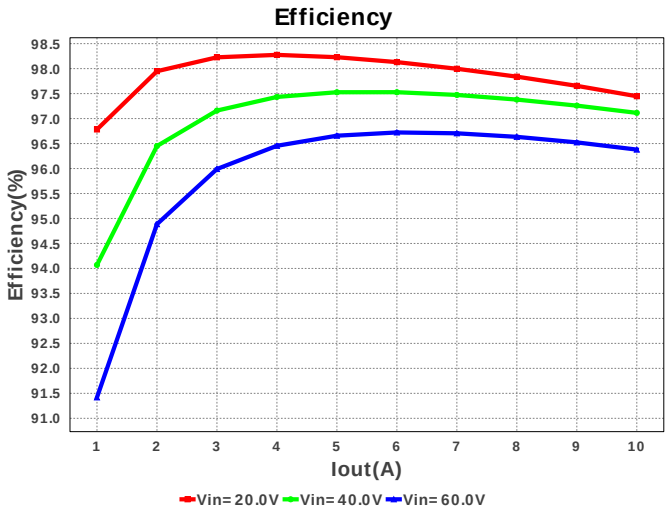


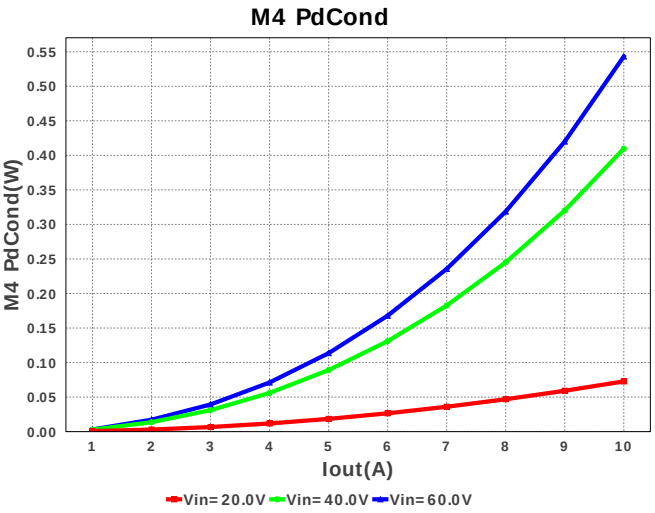


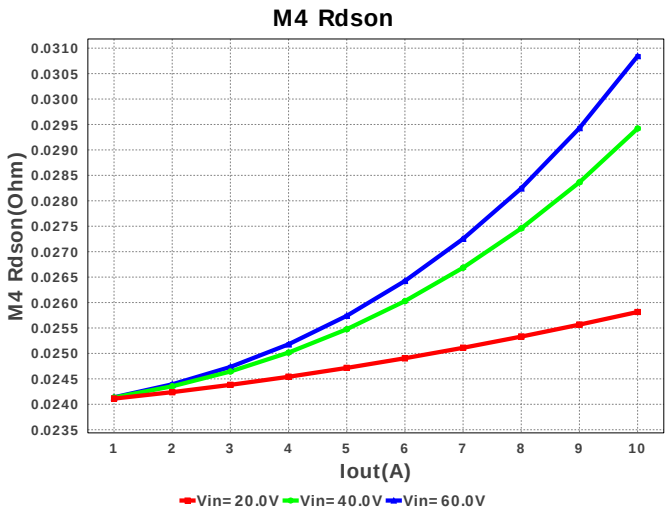


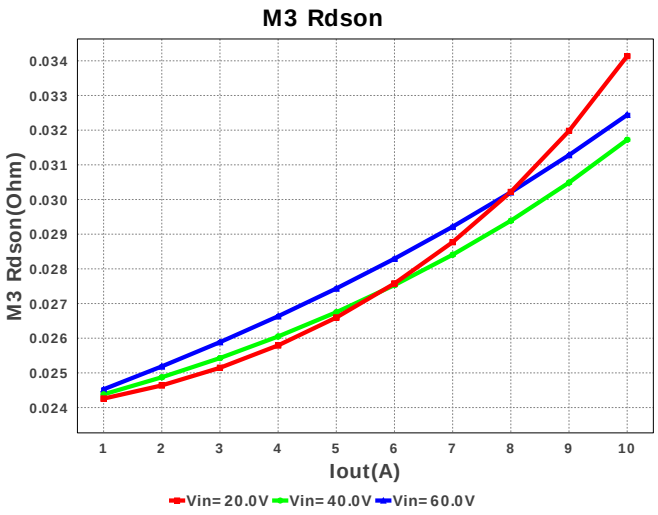


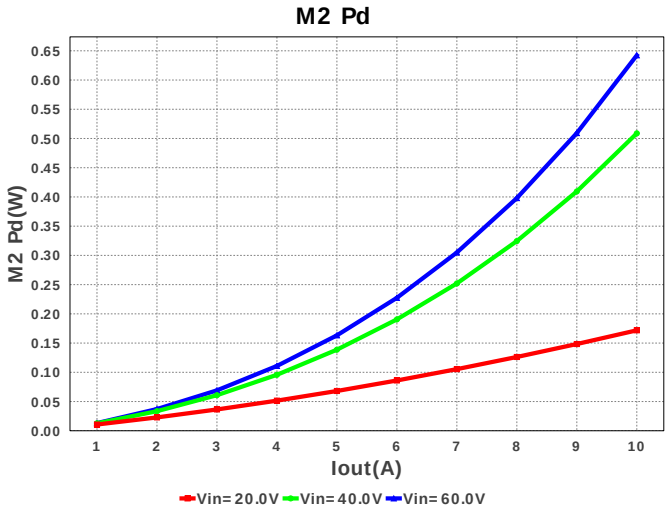


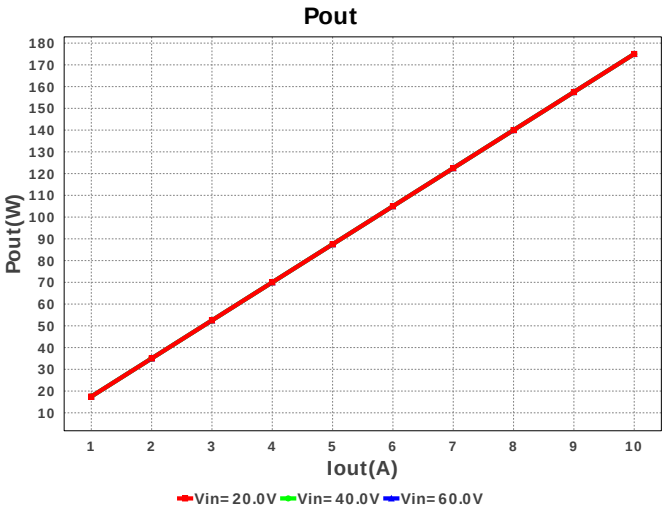


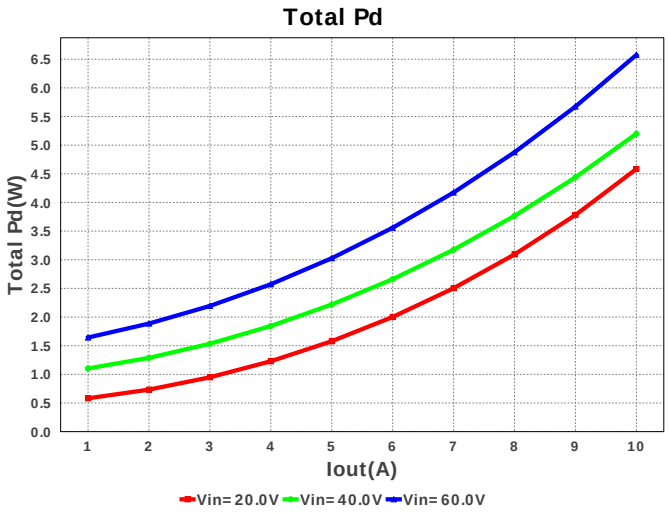


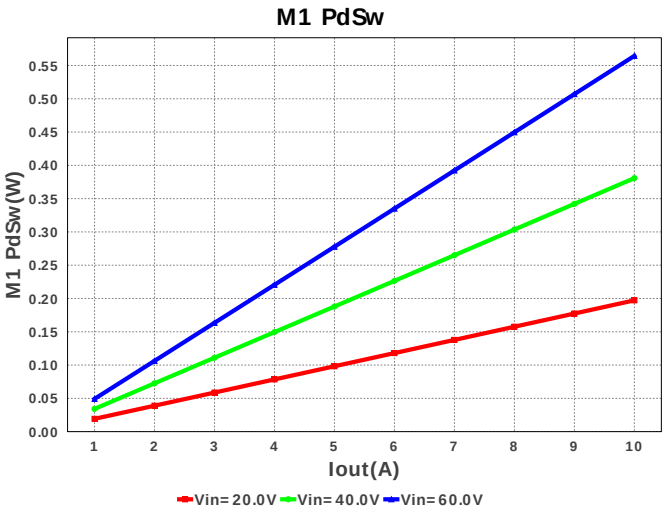


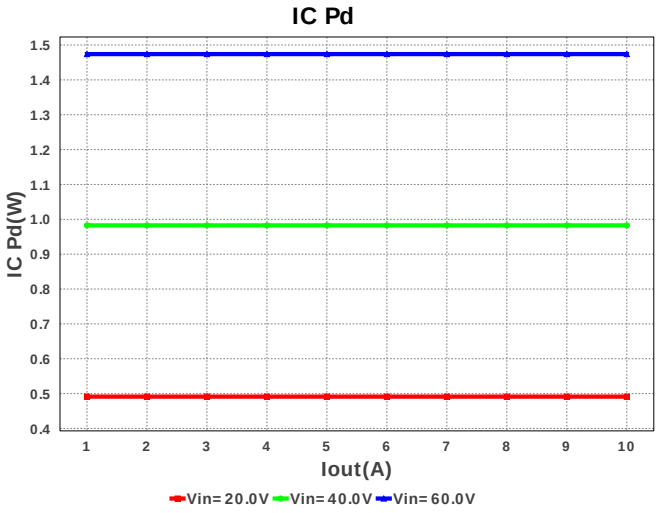


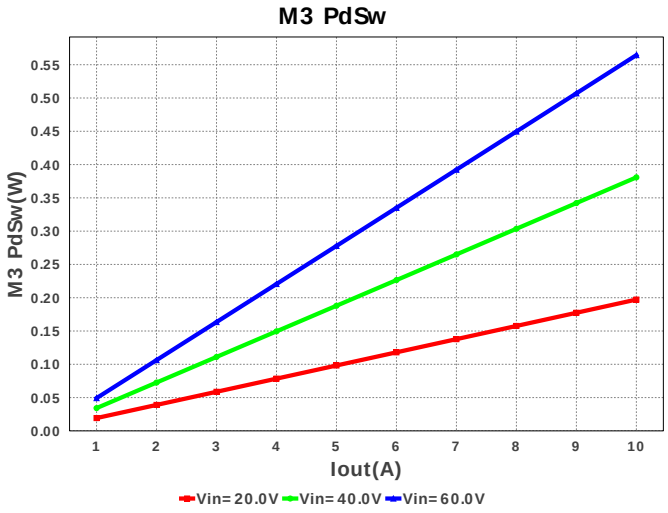


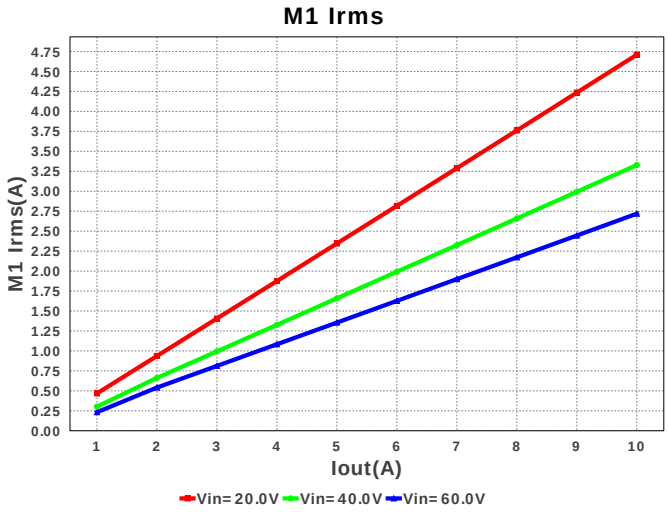


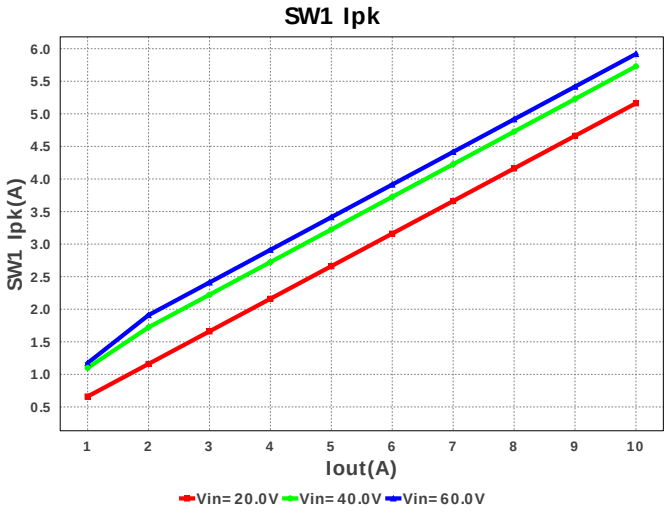


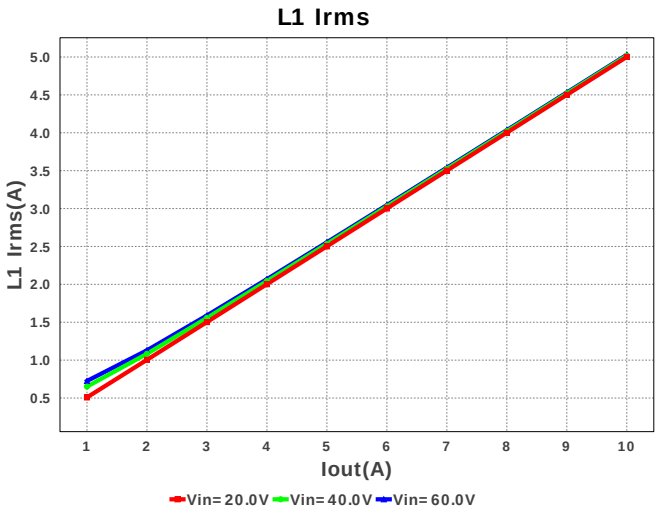


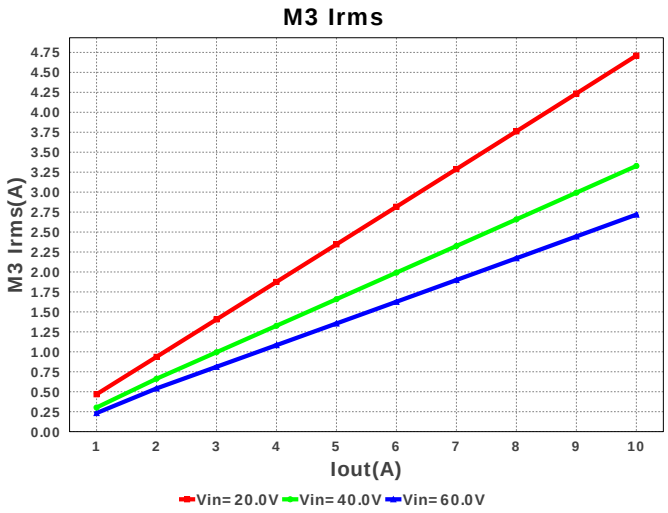


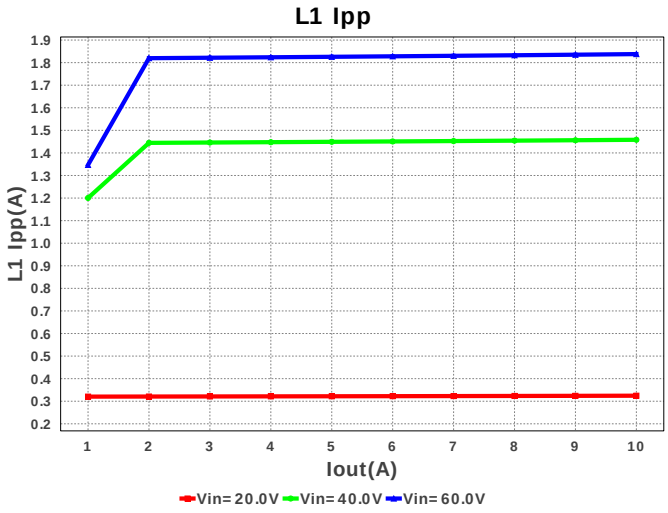


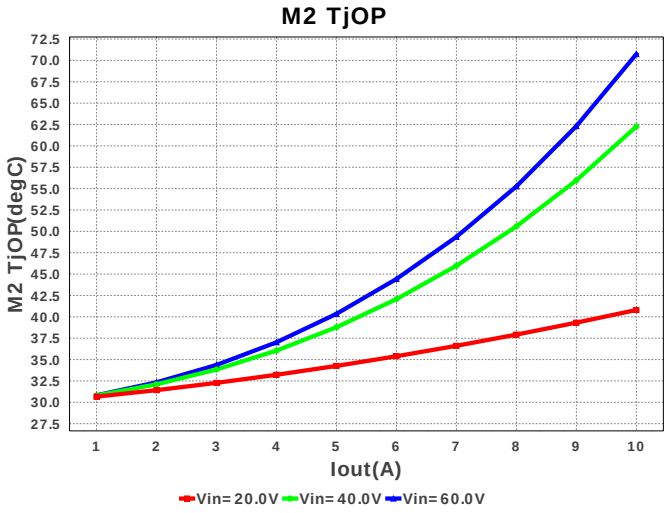


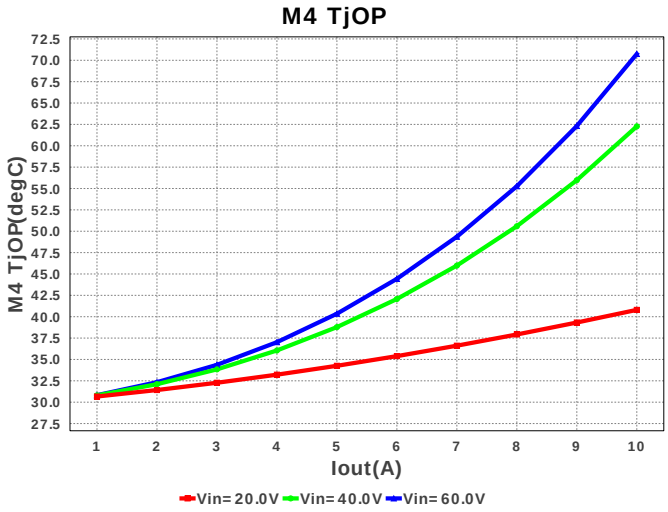


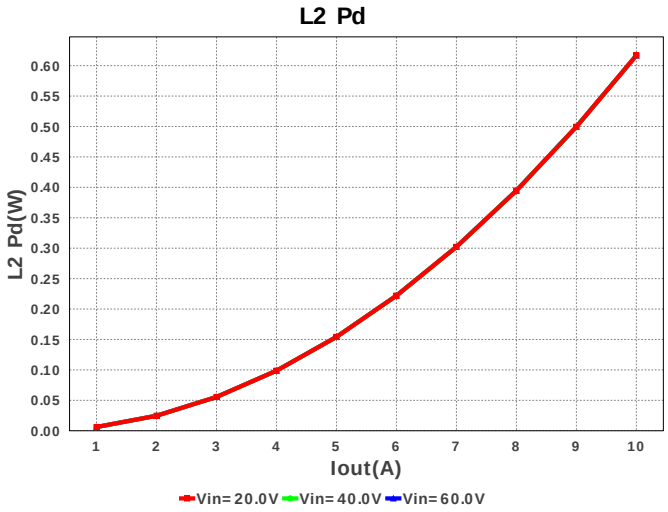


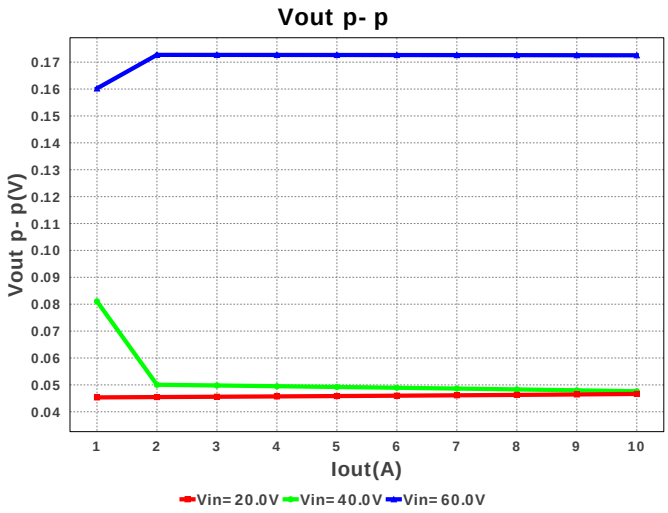


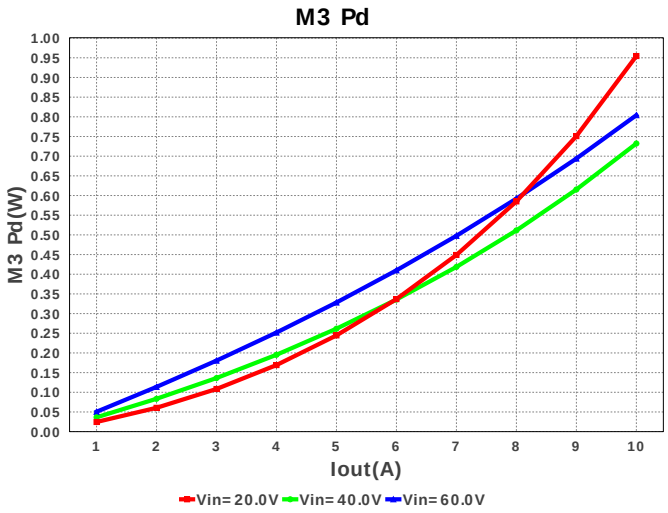


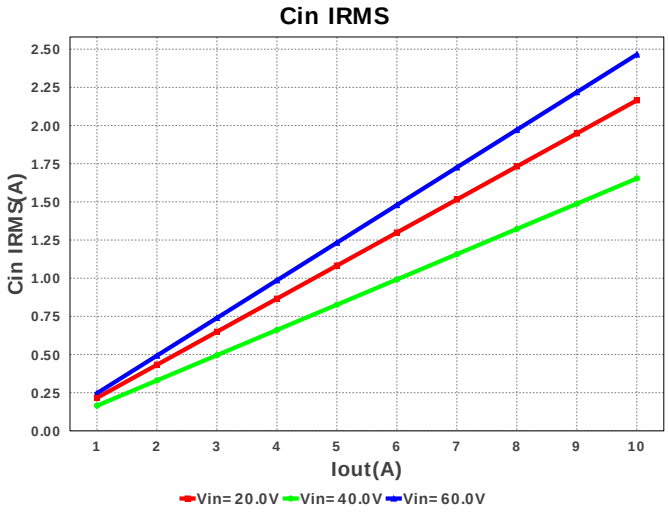












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.465 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	311.226 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	3.029 A	Current	Average input current
4.	L1 Ipp	1.838 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	5.028 A	Current	Inductor ripple current
6.	L2Ipp	1.838 A	Current	Channel 2 Inductor Peak to peak Current
7.	L2 Irms	5.028 A	Current	Inductor ripple current
8.	M1 Irms	2.718 A	Current	MOSFET RMS ripple current
9.	M2 Irms	4.197 A	Current	MOSFET RMS ripple current
10.	M3 Irms	2.719 A	Current	MOSFET RMS ripple current
11.	M4 Irms	4.196 A	Current	MOSFET RMS ripple current
12.	SW1 Ipk	5.919 A	Current	Peak switch current
13.	SW2 Ipk	5.919 A	Current	Peak switch current
14.	BOM Count	34	General	Total Design BOM count
15.	FootPrint	2.869 kmm2	General	Total Foot Print Area of BOM components
16.	Frequency	145.463 kHz	General	Switching frequency
17.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
18.	Pout	174.957 W	General	Total output power
19.	Total BOM	$10.13	General	Total BOM Cost
20.	M3 TjOP	80.243 degC	Op_Point	M3 MOSFET junction temperature
21.	M4 TjOP	70.738 degC	Op_Point	M4 MOSFET junction temperature
22.	Vout OP	17.496 V	Op_Point	Operational Output Voltage
23.	Duty Cycle	29.556 %	Op_point	Duty cycle
24.	Efficiency	96.266 %	Op_point	Steady state efficiency
25.	IC Tj	88.959 degC	Op_point	IC junction temperature
26.	IOUT_OP	10.0 A	Op_point	Iout operating point
27.	M1 TjOP	80.239 degC	Op_point	M1 MOSFET junction temperature
28.	M2 TjOP	70.743 degC	Op_point	M2 MOSFET junction temperature
29.	VIN_OP	60.0 V	Op_point	Vin operating point
30.	Vout p-p	172.55 mV	Op_point	Peak-to-peak output ripple voltage
31.	Cin Pd	740.463 mW	Power	Input capacitor power dissipation
32.	Cout Pd	7.749 mW	Power	Output capacitor power dissipation
33.	IC Pd	1.474 W	Power	IC power dissipation
34.	L1 Pd	616.782 mW	Power	Inductor power dissipation
35.	L2 Pd	616.782 mW	Power	Inductor power dissipation
36.	M1 Pd	804.099 mW	Power	M1 MOSFET total power dissipation
37.	M1 PdCond	239.702 mW	Power	M1 MOSFET conduction losses
38.	M1 PdSw	564.397 mW	Power	M1 MOSFET switching losses
39.	M2 Pd	642.347 mW	Power	M2 MOSFET total power dissipation
40.	M2 PdCond	543.206 mW	Power	M2 MOSFET conduction losses
41.	M2 PdSw	99.142 mW	Power	M2 MOSFET switching losses
42.	M3 Pd	804.161 mW	Power	M1 MOSFET total power dissipation
43.	M3 PdCond	239.766 mW	Power	M1 MOSFET conduction losses
44.	M3 PdSw	564.395 mW	Power	M1 MOSFET switching losses
45.	M1 Rdson	32.44 mOhm	Power	Drain-Source On-resistance
46.	M3 Rdson	32.441 mOhm	Power	Drain-Source On-resistance
47.	M4 Pd	642.279 mW	Power	M2 MOSFET total power dissipation
48.	M4 PdCond	543.137 mW	Power	M2 MOSFET conduction losses
49.	M4 PdSw	99.142 mW	Power	M2 MOSFET switching losses
50.	M2 Rdson	30.845 mOhm	Power	Drain-Source On-resistance
51.	M4 Rdson	30.844 mOhm	Power	Drain-Source On-resistance
52.	Rsense1 Pd	211.331 mW	Power	Current Limit Sense Resistor Power Dissipation

#	Name	Value	Category	Description
53.	Rsense2 Pd	211.31 mW	Power	Current Limit Sense Resistor Power Dissipation
54.	Total Pd	6.787 W	Power	Total Power Dissipation
55.	Cross Freq Ch1	13.483 kHz	Unknown	Bode plot crossover frequency
56.	Phase Marg Ch1	62.251 deg	Unknown	Bode Plot Phase Margin

Design Inputs

#	Name	Value	Description
1.	Iout	10.0 A	Maximum Output Current
2.	Iout1	10.0 Amps	Output Current #1
3.	VinMax	60.0 V	Maximum input voltage
4.	VinMin	20.0 V	Minimum input voltage
5.	Vout	17.5 V	Output Voltage
6.	Vout1	17.5 Volt	Output Voltage #1
7.	base_pn	LM5119	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0 degC	Ambient temperature

Design Assistance

1. Outline The LM5119 is a dual synchronous buck controller intended for step-down regulator applications from a high voltage or widely varying input supply. The control method is based upon current mode control utilizing an emulated current ramp. Current mode control provides inherent line feed-forward, cycle-by-cycle current limiting and ease of loop compensation. The use of an emulated control ramp reduces noise sensitivity of the pulse-width modulation circuit, allowing reliable control of very small duty cycles necessary in high input voltage applications. Interleaved Operation Interleaved operation can offer many advantages in single output, high current applications. The output power path is split between two identical channels reducing the current in each channel by one-half. Ripple current reduction in the output capacitors is reduced significantly since each channel operates 180 degrees out of phase from the other. Diode Emulation A fully synchronous buck regulator implemented with a freewheel MOSFET rather than a diode has the capability to sink current from the output in certain conditions such as light load, over-voltage or pre-bias startup. The LM(2)5119 provides a diode emulation feature that can be enabled to prevent reverse (drain to source) current flow in the low side free-wheel MOSFET.

2. **LM5119** Product Folder : http://www.ti.com/product/lm5119 : contains the data sheet and other resources.