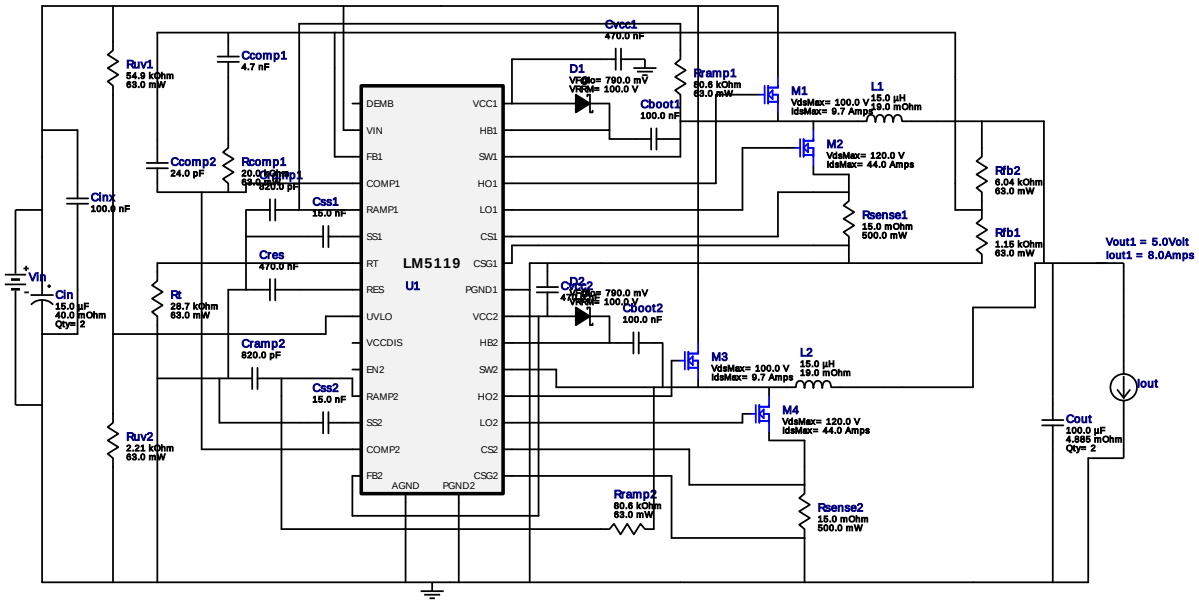
WEBENCH® Design Report

VinMin = 40.0V
VinMax = 60.0V
Vout = 5.0V
Iout = 8.0A

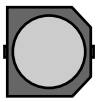
Device = LM5119PSQ/NOPB
Topology = Buck
Created = 3/14/16 6:09:33 PM
BOM Cost = $0.00
BOM Count = 35
Total Pd = 5.11W

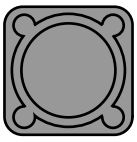
Design : 4161985/25 LM5119PSQ/NOPB
LM5119PSQ/NOPB 40.0V-60.0V to 5.00V @ 8.0A



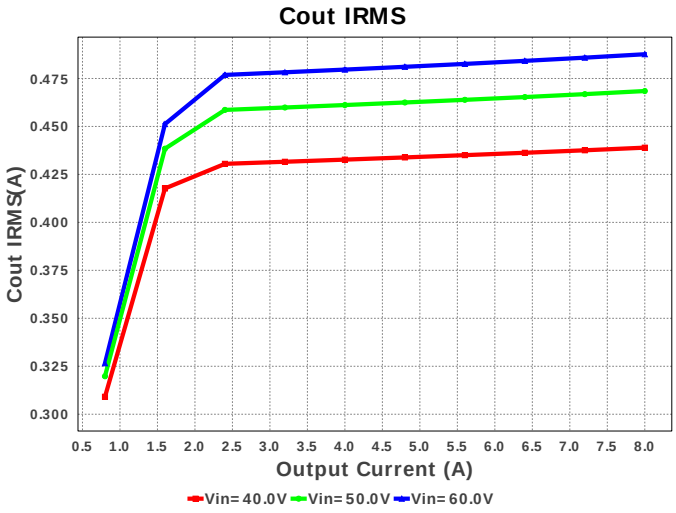
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

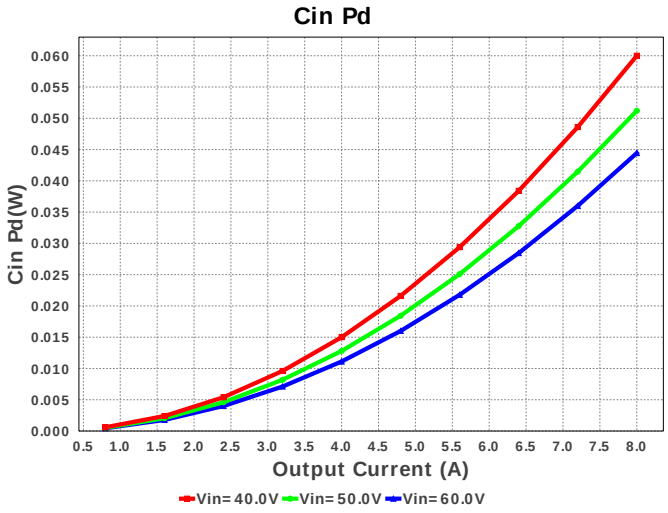
Electrical BOM

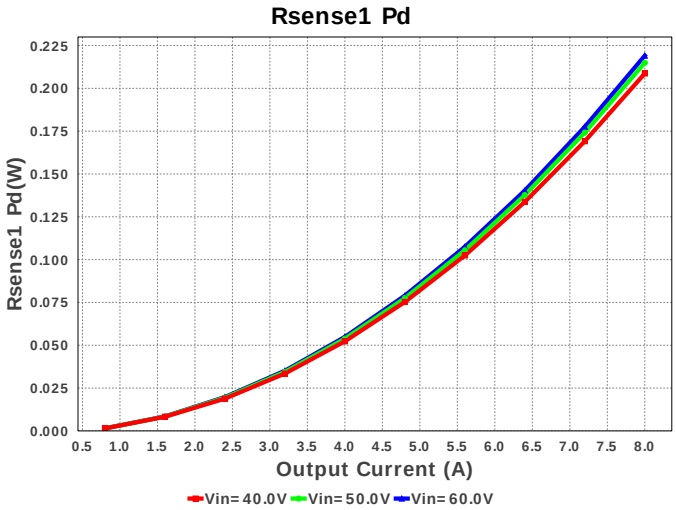
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot1	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cboot2	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
3.	Ccomp1	Yageo America	CC0805KRX7R9BB472 Series= X7R	Cap= 4.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Ccomp2	Samsung Electro-Mechanics	CL21C240JBANNNC Series= C0G/NP0	Cap= 24.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Cin	Panasonic	100SXV15M Series= SXV	Cap= 15.0 uF ESR= 40.0 mOhm VDC= 100.0 V IRMS= 2.35 A	2	$1.25	 CAPSMT_62_E12 106 mm²
6.	Cinx	Taiyo Yuden	HMK212B7104KG-T Series= X7R	Cap= 100.0 nF VDC= 100.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm²
7.	Cout	MuRata	GRM31CR60J107ME39L Series= X5R	Cap= 100.0 uF ESR= 4.885 mOhm VDC= 6.3 V IRMS= 4.4118 A	2	$0.20	1206_190 11 mm²
8.	Cramp1	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²

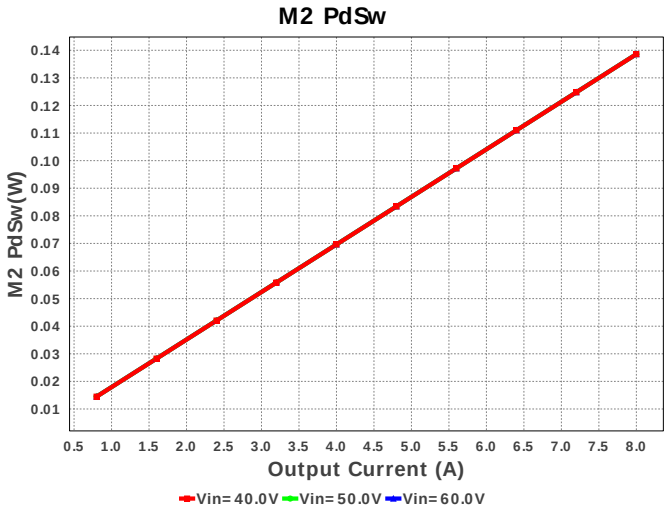
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cramp2	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
10.	Cres	MuRata	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
11.	Css1	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
12.	Css2	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
13.	Cvcc1	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
14.	Cvcc2	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
15.	D1	International Rectifier	30BQ100TRPBF	VF@Io= 790.0 mV VRRM= 100.0 V	1	NA	 SMC 83 mm²
16.	D2	International Rectifier	30BQ100TRPBF	VF@Io= 790.0 mV VRRM= 100.0 V	1	NA	 SMC 83 mm²
17.	L1	Coilcraft	MSS1210-153MEB	L= 15.0 µH DCR= 19.0 mOhm	1	$0.81	 MSS1210 204 mm²
18.	L2	Coilcraft	MSS1210-153MEB	L= 15.0 µH DCR= 19.0 mOhm	1	$0.81	 MSS1210 204 mm²
19.	M1	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 9.7 Amps	1	$0.65	 TRANS_NexFET_Q3 18 mm²
20.	M2	Infineon Technologies	BSC190N12NS3 G	VdsMax= 120.0 V IdsMax= 44.0 Amps	1	$0.64	 PG-TDSON-8 55 mm²
21.	M3	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 9.7 Amps	1	$0.65	 TRANS_NexFET_Q3 18 mm²
22.	M4	Infineon Technologies	BSC190N12NS3 G	VdsMax= 120.0 V IdsMax= 44.0 Amps	1	$0.64	 PG-TDSON-8 55 mm²
23.	Rcomp1	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
24.	Rfb1	Vishay-Dale	CRCW04021K15FKED Series= CRCW..e3	Res= 1.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
25.	Rfb2	Vishay-Dale	CRCW04026K04FKED Series= CRCW..e3	Res= 6.04 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

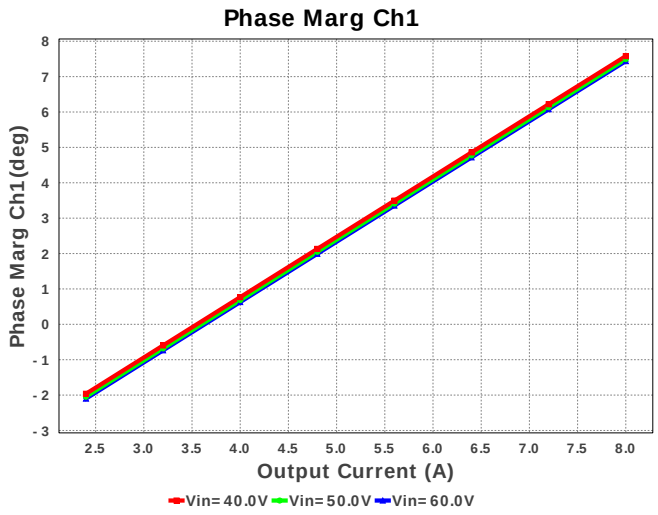
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	Rramp1	Vishay-Dale	CRCW040280K6FKED Series= CRCW..e3	Res= 80.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
27.	Rramp2	Vishay-Dale	CRCW040280K6FKED Series= CRCW..e3	Res= 80.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
28.	Rsense1	Stackpole Electronics Inc	CSR1206FK15L0 Series= ?	Res= 15.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	1206 11 mm²
29.	Rsense2	Stackpole Electronics Inc	CSR1206FK15L0 Series= ?	Res= 15.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	1206 11 mm²
30.	Rt	Vishay-Dale	CRCW040228K7FKED Series= CRCW..e3	Res= 28.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
31.	Ruv1	Vishay-Dale	CRCW040254K9FKED Series= CRCW..e3	Res= 54.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
32.	Ruv2	Vishay-Dale	CRCW04022K21FKED Series= CRCW..e3	Res= 2.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
33.	U1	Texas Instruments	LM5119PSQ/NOPB	Switcher	1	$3.25	SQA32A 49 mm²

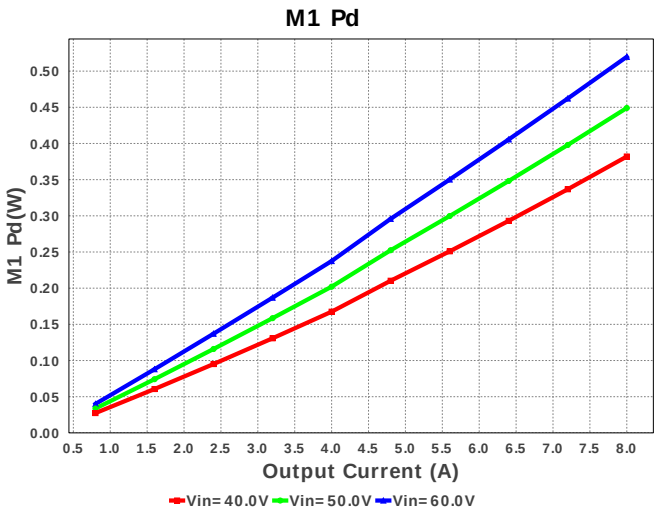


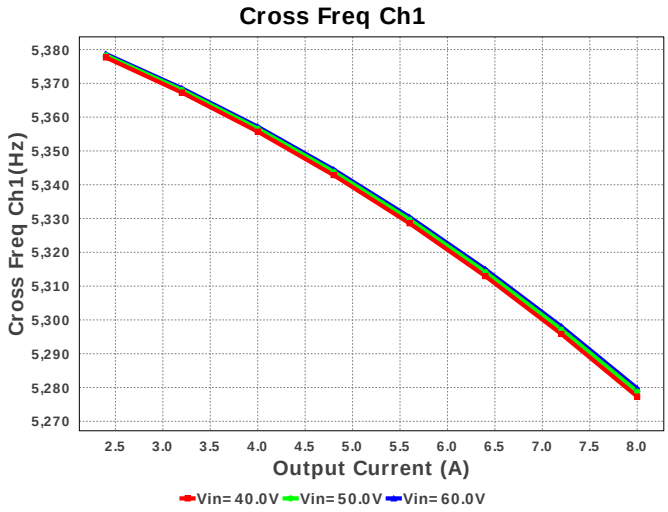


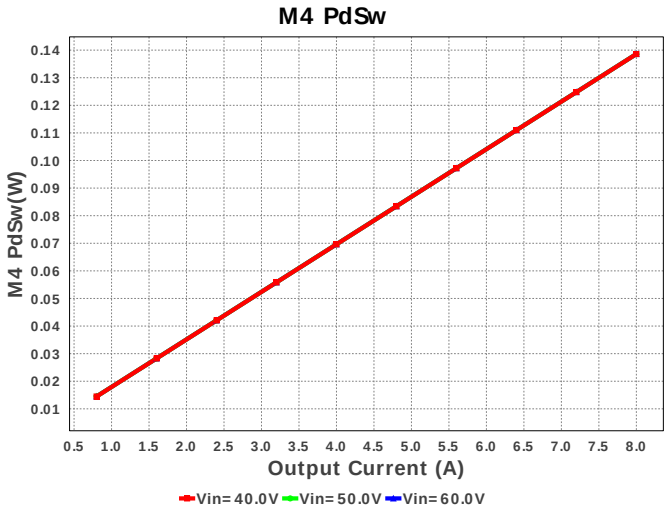


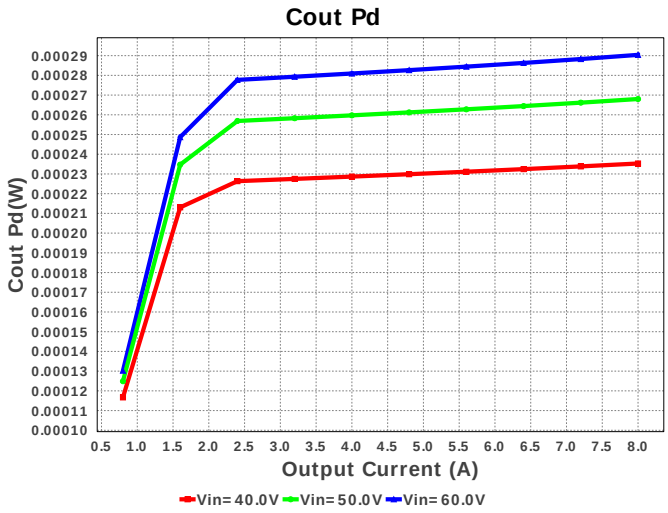


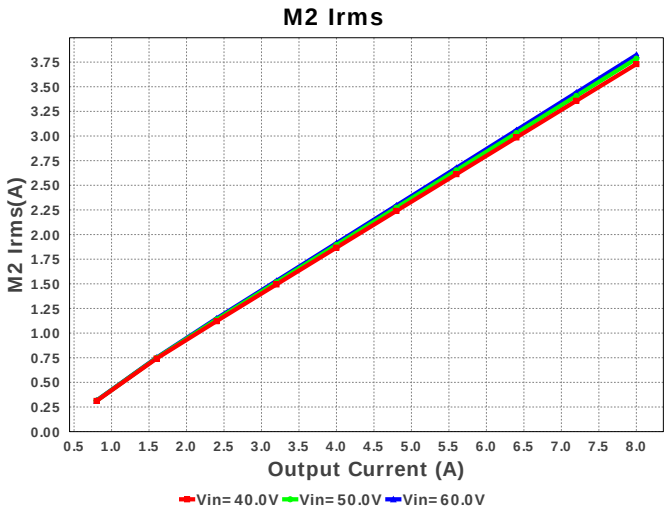


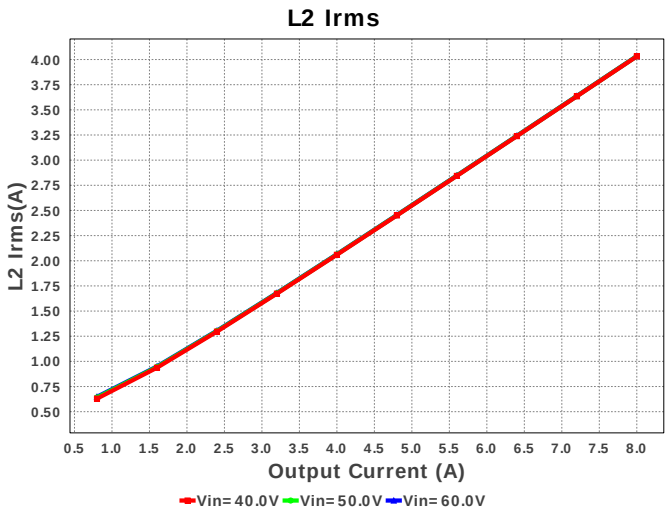


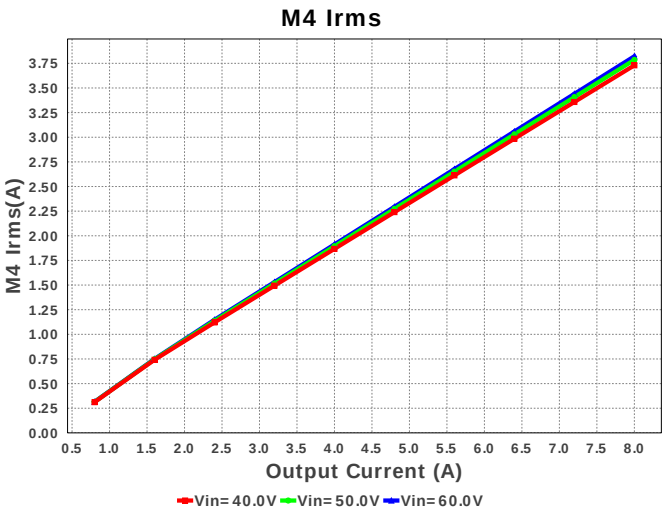


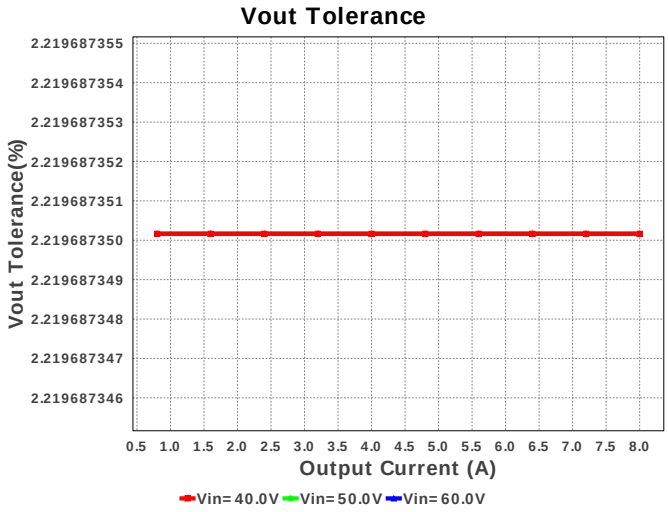


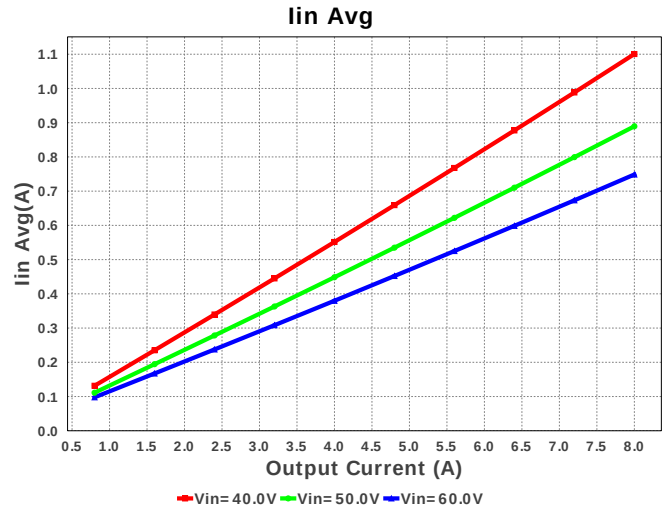


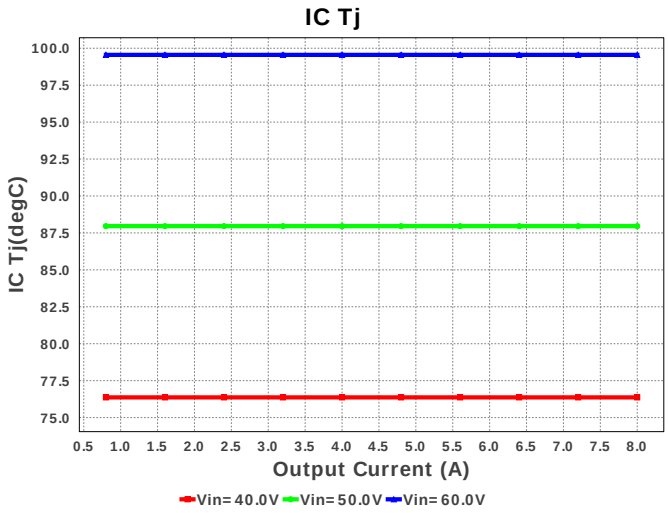


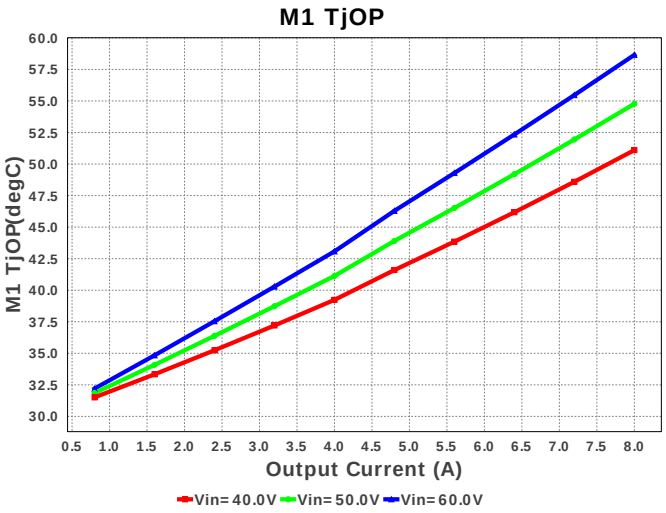


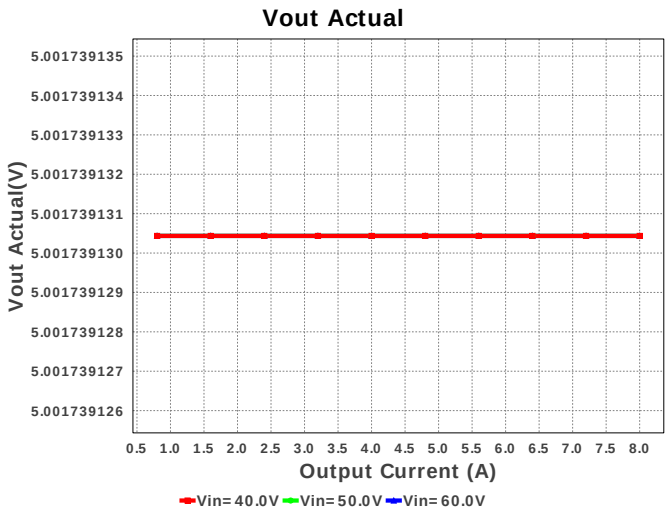


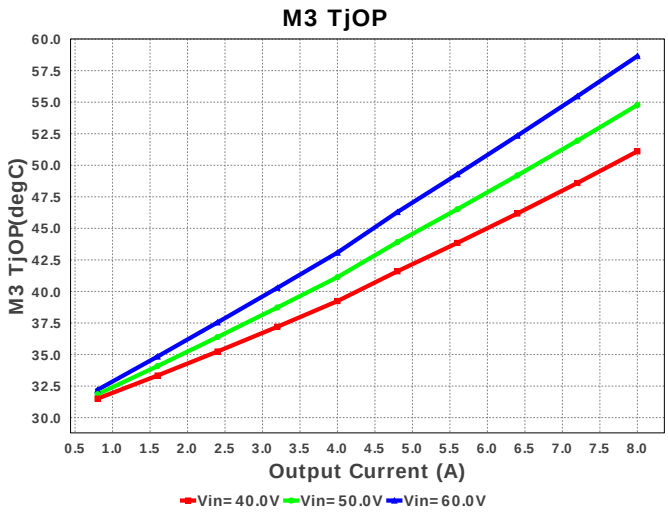


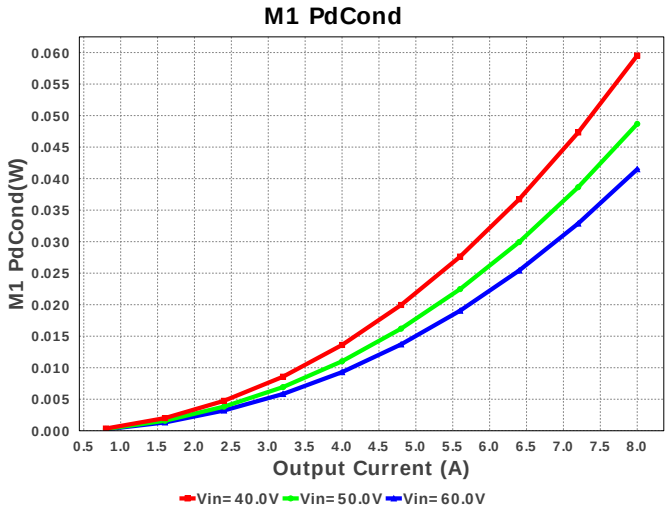


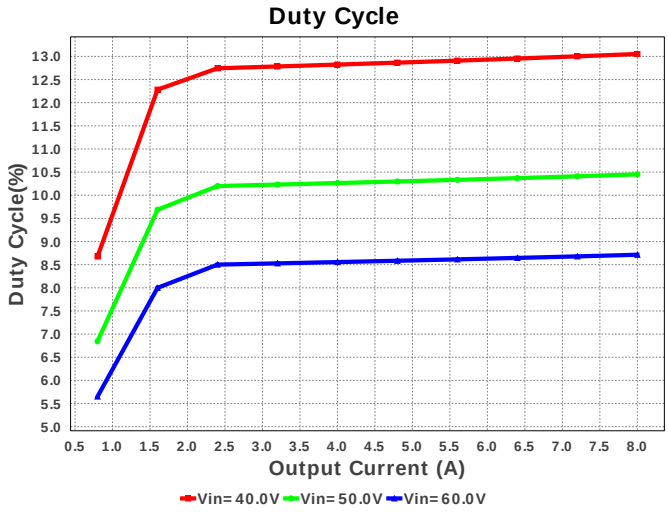


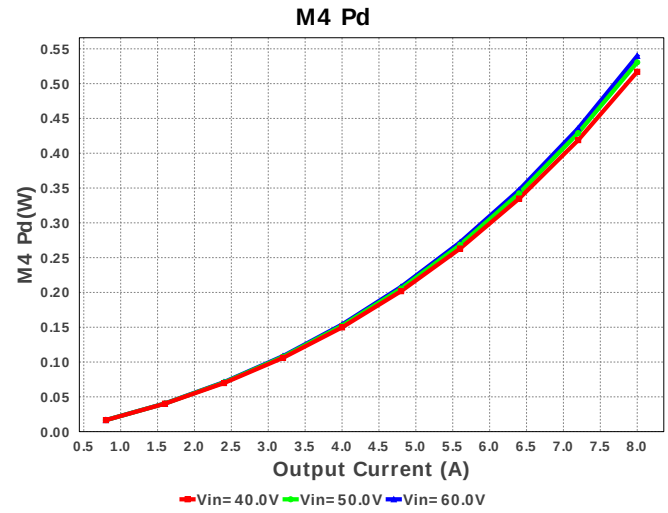


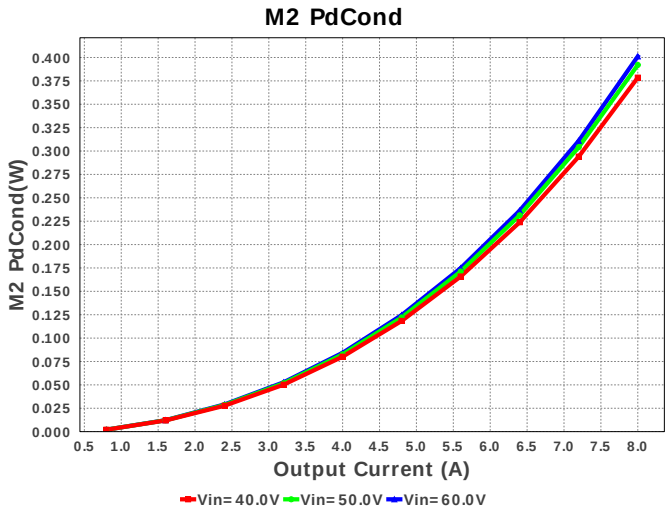


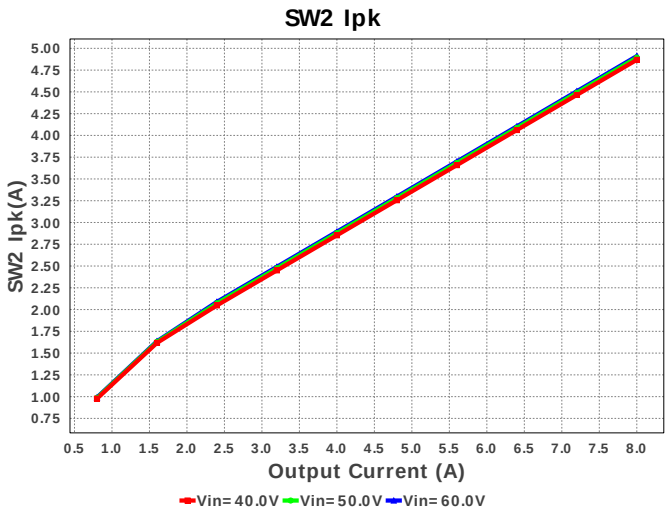


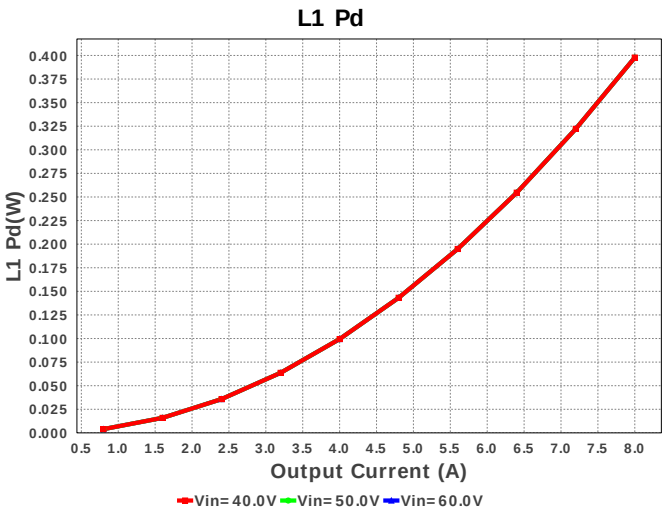


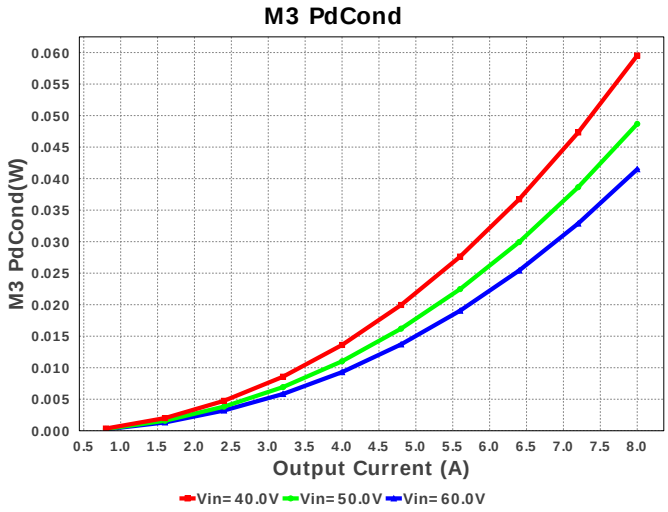


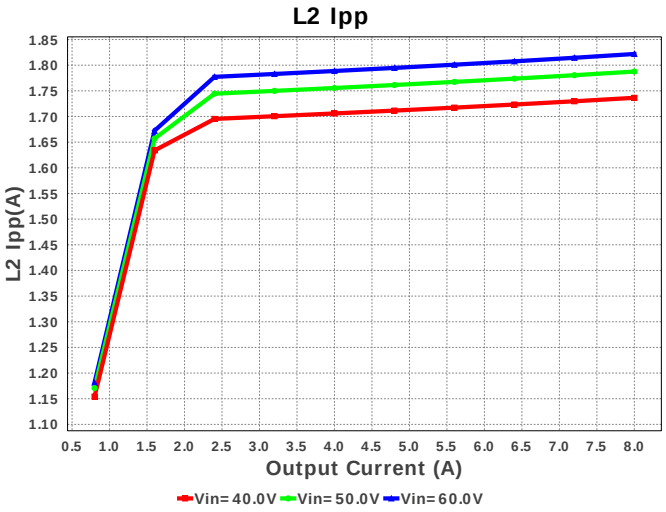


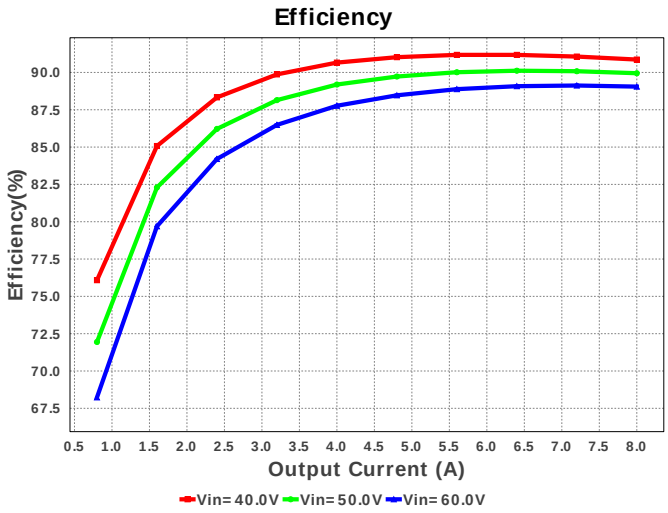


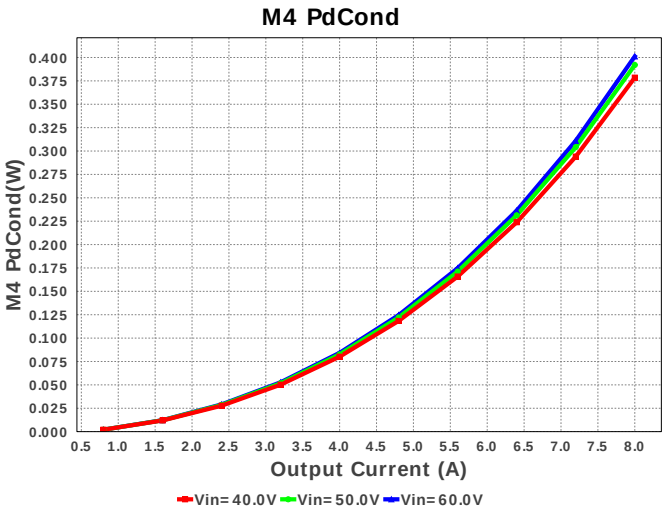


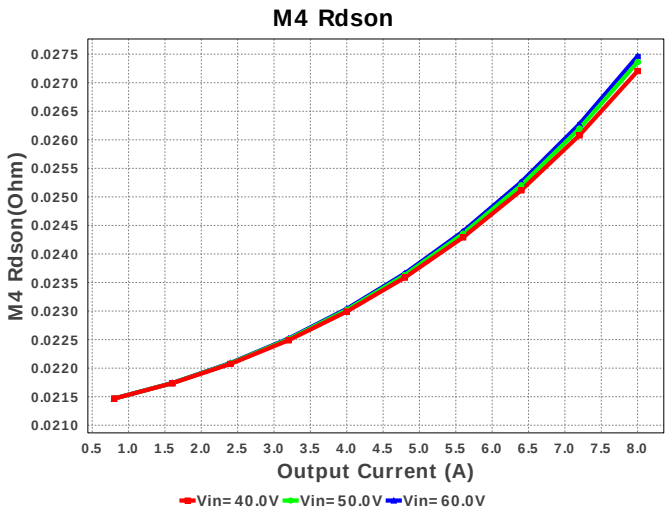


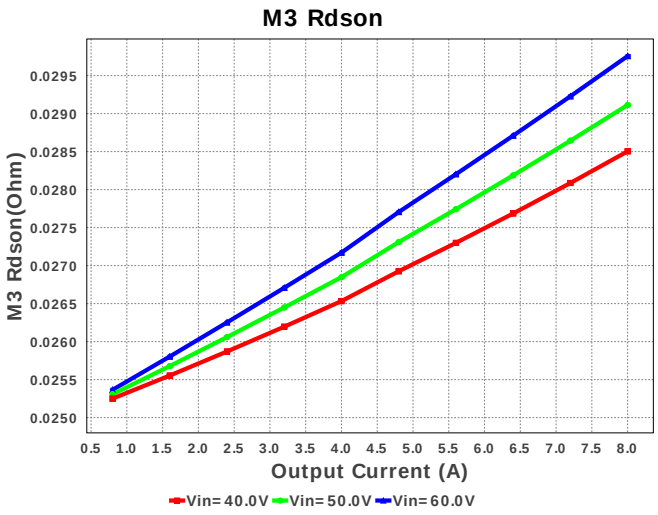


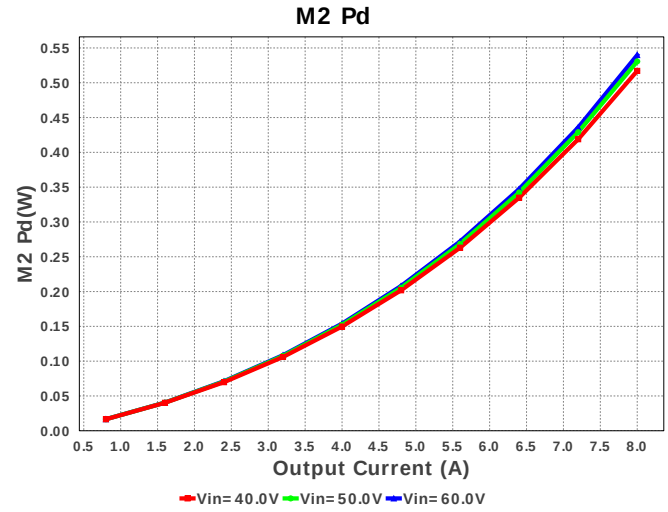


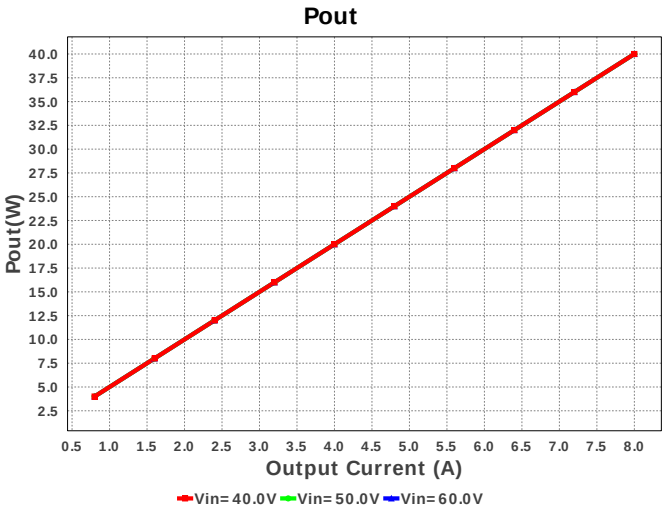


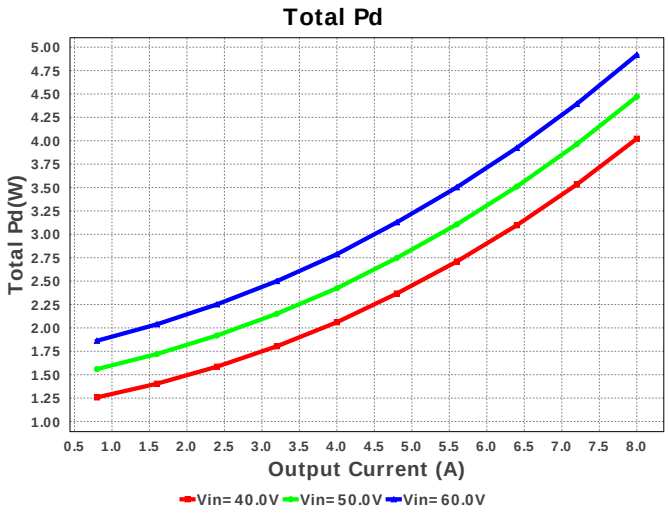


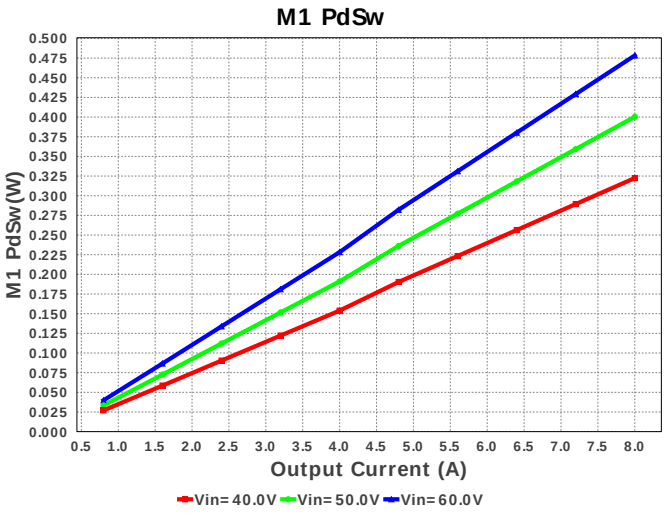


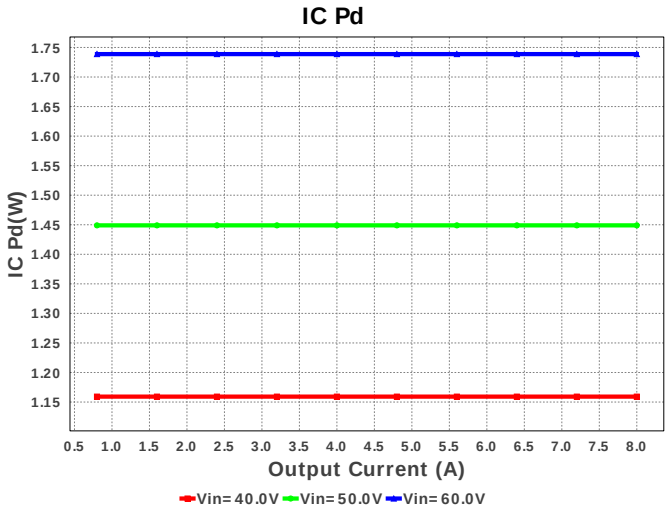


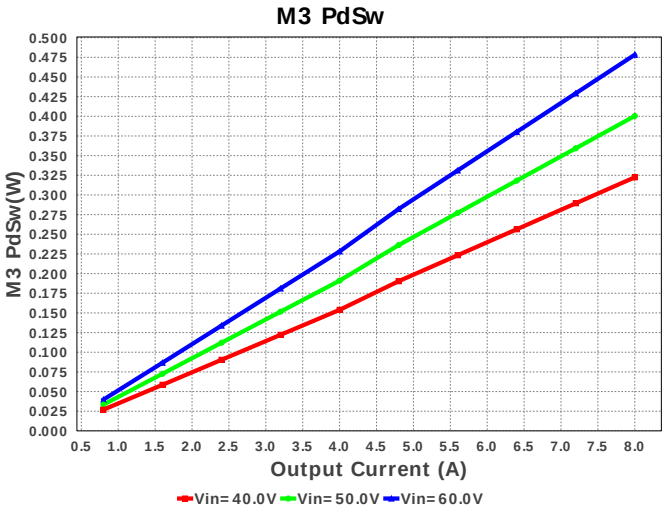


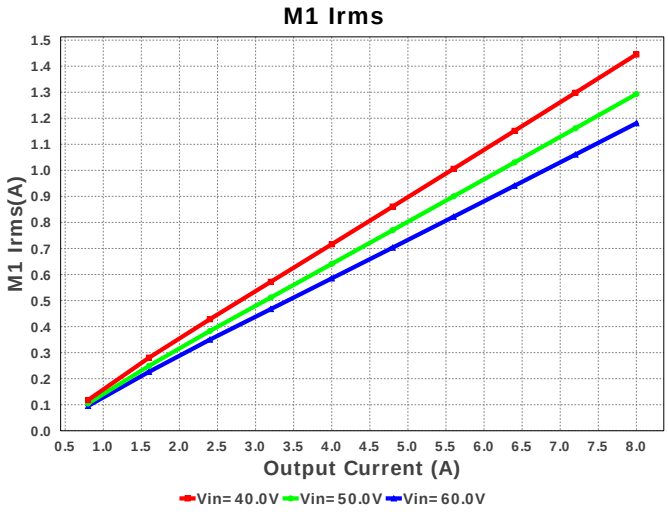


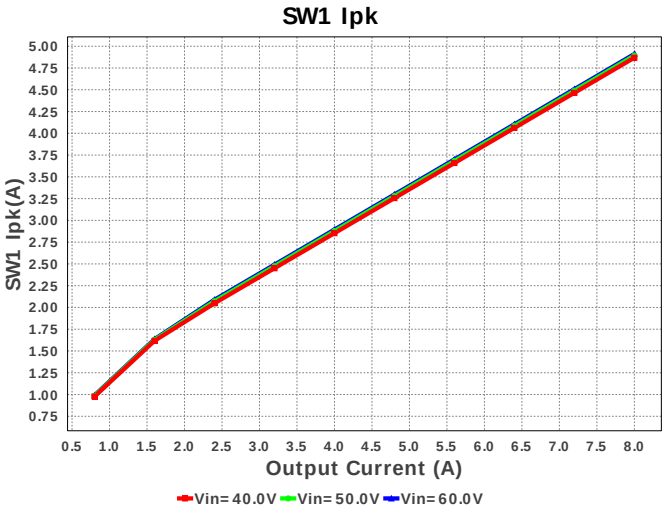


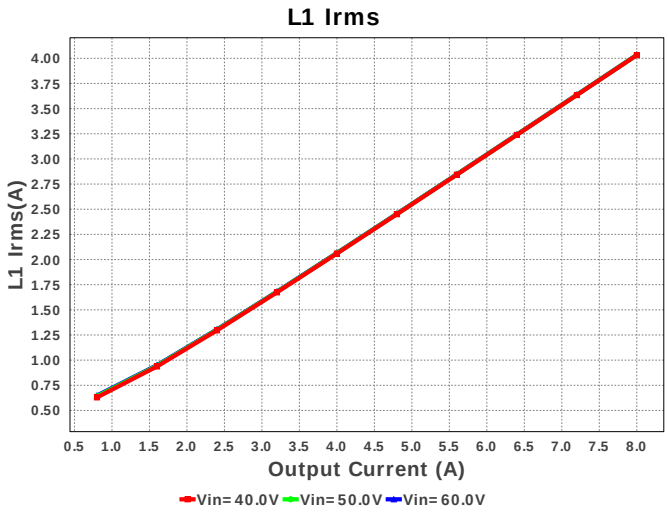


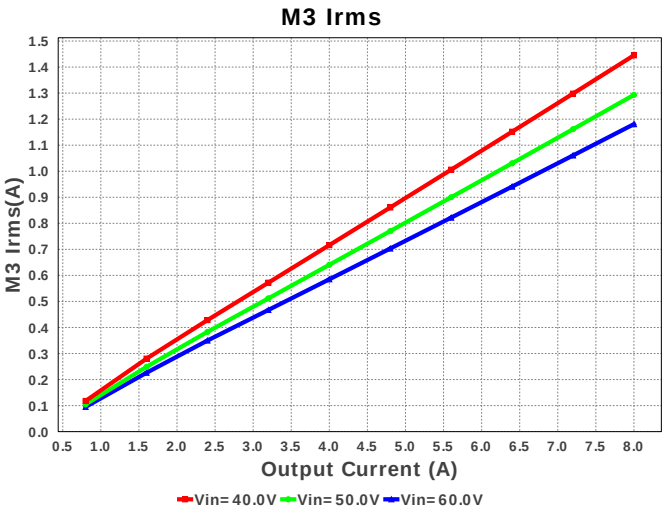


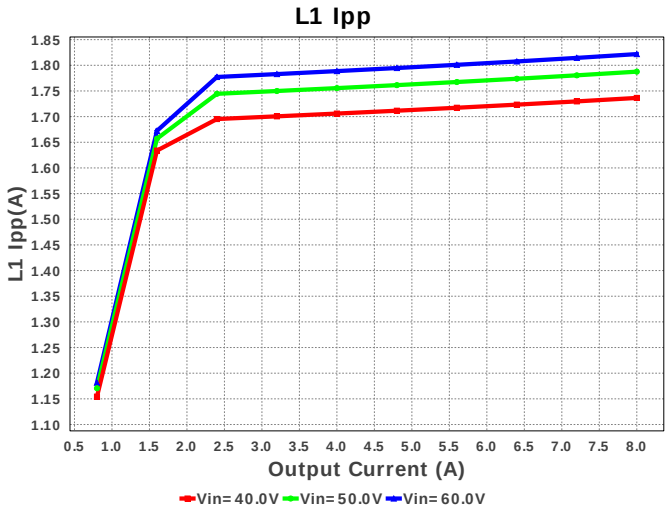


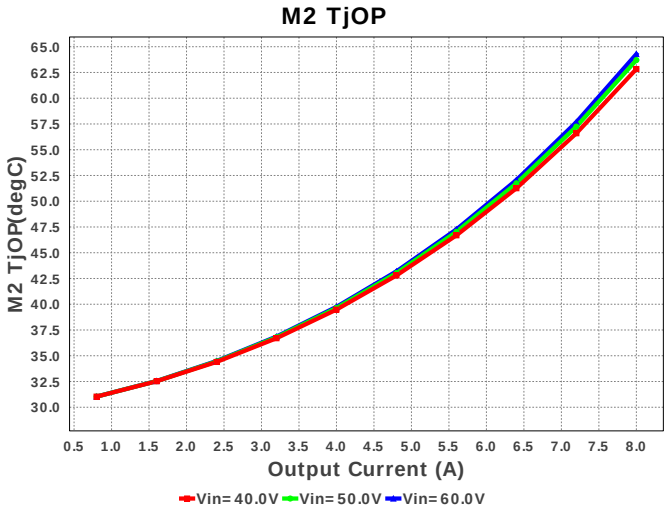


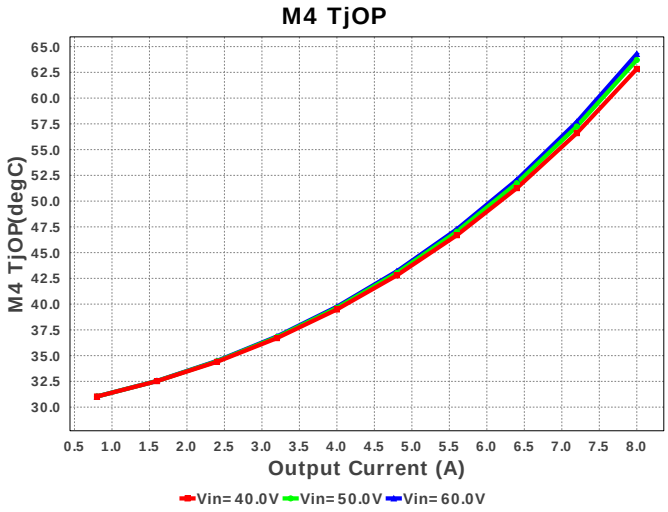


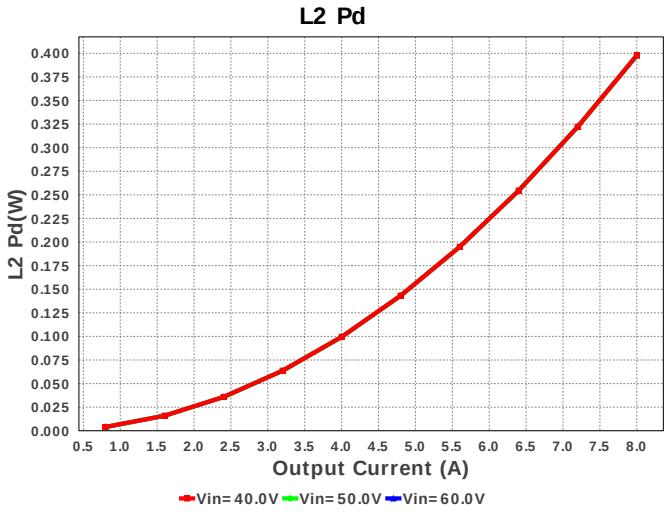


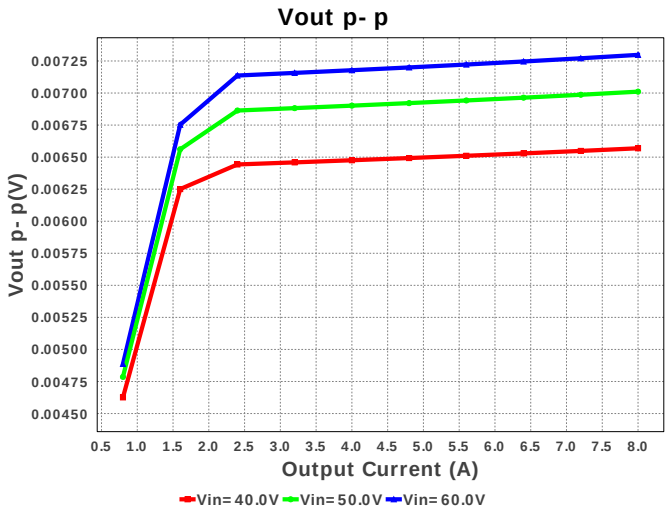


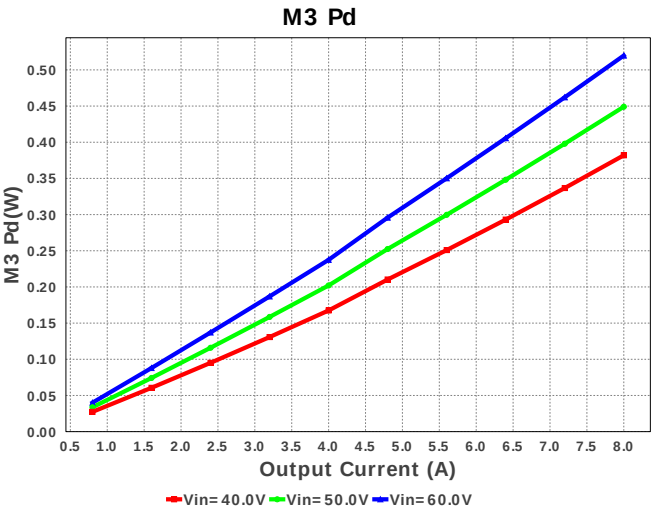


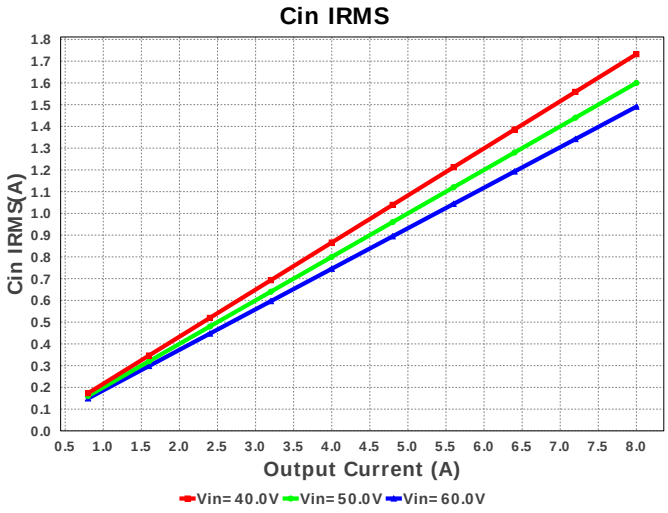












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.491 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	487.632 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	751.93 mA	Current	Average input current
4.	L1 Ipp	1.822 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	4.034 A	Current	Inductor ripple current
6.	L2 Ipp	1.822 A	Current	Inductor 2 peak to peak current
7.	L2 Irms	4.034 A	Current	Inductor ripple current
8.	M1 Irms	1.181 A	Current	MOSFET RMS ripple current
9.	M2 Irms	3.822 A	Current	MOSFET RMS ripple current
10.	M3 Irms	1.181 A	Current	MOSFET RMS ripple current
11.	M4 Irms	3.822 A	Current	MOSFET RMS ripple current
12.	SW1 Ipk	4.911 A	Current	Peak switch current
13.	SW2 Ipk	4.911 A	Current	Peak switch current
14.	BOM Count	35	General	Total Design BOM count
15.	FootPrint	1.114 k mm^2	General	Total Foot Print Area of BOM components
16.	Frequency	175.391 kHz	General	Switching frequency
17.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
18.	Pout	40.014 W	General	Total output power
19.	Total BOM	$0.0	General	Total BOM Cost
20.	M3 TjOP	57.878 degC	Op_Point	M3 MOSFET junction temperature
21.	M4 TjOP	64.283 degC	Op_Point	M4 MOSFET junction temperature
22.	Vout Actual	5.002 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
23.	Vout OP	5.002 V	Op_Point	Operational Output Voltage
24.	Duty Cycle	8.717 %	Op_point	Duty cycle
25.	Efficiency	88.676 %	Op_point	Steady state efficiency
26.	IC Tj	99.551 degC	Op_point	IC junction temperature
27.	IOUT_OP	8.0 A	Op_point	Iout operating point
28.	M1 TjOP	57.879 degC	Op_point	M1 MOSFET junction temperature
29.	M2 TjOP	64.282 degC	Op_point	M2 MOSFET junction temperature
30.	VIN_OP	60.0 V	Op_point	Vin operating point
31.	Vout p-p	7.298 mV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	44.451 mW	Power	Input capacitor power dissipation
33.	Cout Pd	290.394 µW	Power	Output capacitor power dissipation
34.	IC Pd	1.739 W	Power	IC power dissipation
35.	L1 Pd	397.773 mW	Power	Inductor power dissipation
36.	L2 Pd	397.773 mW	Power	Inductor power dissipation
37.	M1 Pd	505.726 mW	Power	M1 MOSFET total power dissipation
38.	M1 PdCond	41.324 mW	Power	M1 MOSFET conduction losses
39.	M1 PdSw	464.402 mW	Power	M1 MOSFET switching losses
40.	M2 Pd	539.754 mW	Power	M2 MOSFET total power dissipation
41.	M2 PdCond	401.151 mW	Power	M2 MOSFET conduction losses
42.	M2 PdSw	138.603 mW	Power	M2 MOSFET switching losses
43.	M3 Pd	505.716 mW	Power	M3 MOSFET total power dissipation
44.	M3 PdCond	41.31 mW	Power	M3 MOSFET conduction losses
45.	M3 PdSw	464.405 mW	Power	M3 MOSFET switching losses
46.	M3 Rdson	29.628 mOhm	Power	Drain-Source On-resistance
47.	M3 Rdson	29.628 mOhm	Power	Drain-Source On-resistance
48.	M4 Pd	539.769 mW	Power	M4 MOSFET total power dissipation
49.	M4 PdCond	401.167 mW	Power	M4 MOSFET conduction losses
50.	M4 PdSw	138.602 mW	Power	M4 MOSFET switching losses
51.	M4 Rdson	27.466 mOhm	Power	Drain-Source On-resistance
52.	M4 Rdson	27.466 mOhm	Power	Drain-Source On-resistance

#	Name	Value	Category	Description
53.	Rsense1 Pd	219.078 mW	Power	Current Limit Sense Resistor Power Dissipation
54.	Rsense2 Pd	219.085 mW	Power	Current Limit Sense Resistor Power Dissipation
55.	Total Pd	5.109 W	Power	Total Power Dissipation
56.	Cross Freq Ch1	15.743 kHz		Bode plot crossover frequency
57.	Phase Marg Ch1	60.715 deg		Bode Plot Phase Margin
58.	Vout Tolerance	2.22 %		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	8.0	Maximum Output Current
2.	VinMax	60.0	Maximum input voltage
3.	VinMin	40.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM5119	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	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.