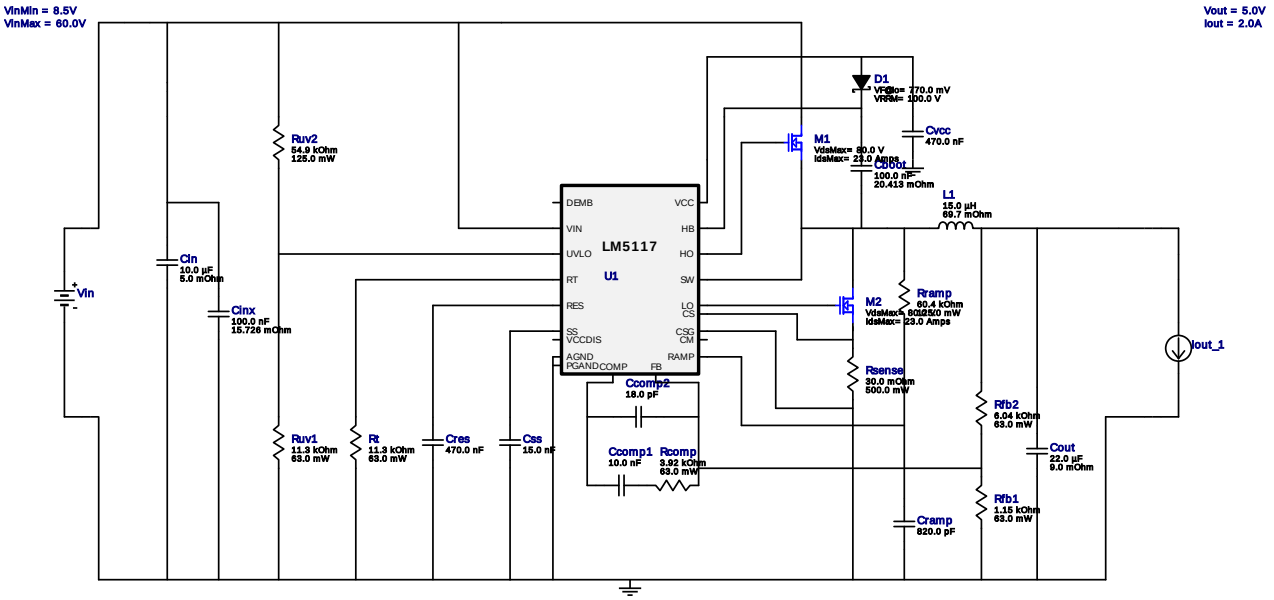
WEBENCH® Design Report

VinMin = 8.5V
VinMax = 60.0V
Vout = 5.0V
Iout = 2.0A

Device = LM5117PMHX/NOPB
Topology = Buck
Created = 7/8/14 4:11:15 PM
BOM Cost = $4.63
Footprint = 398.0mm2
BOM Count = 2
Total Pd = 2.1W

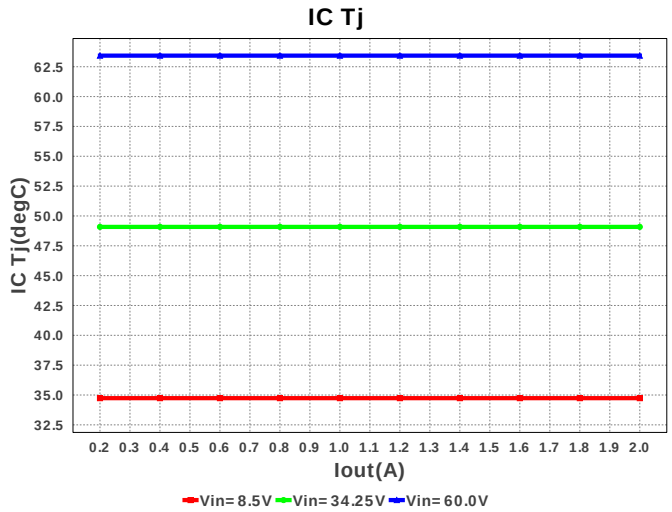
Design : 1688335/26 LM5117PMHX/NOPB
LM5117PMHX/NOPB 8.5V-60.0V to 5.001739130434783V @ 2.0A

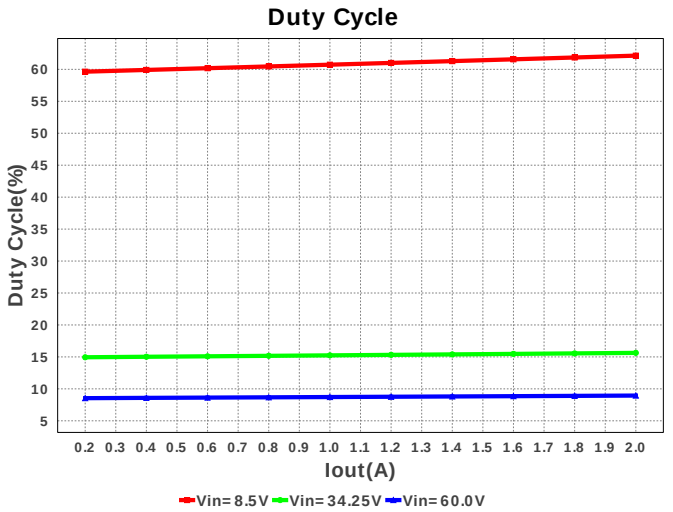


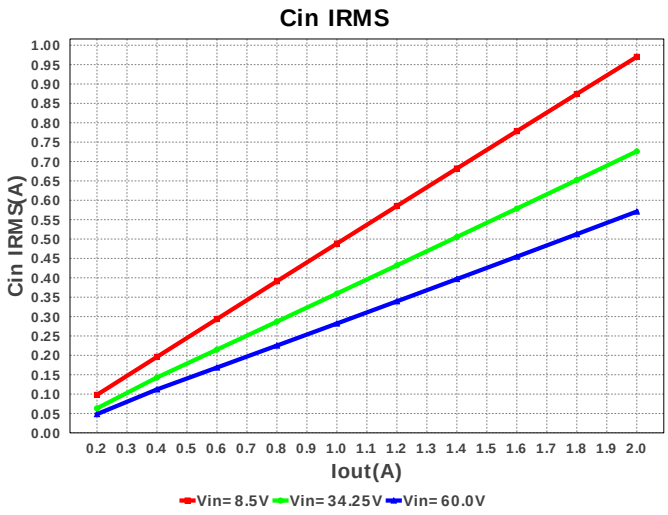
Electrical BOM

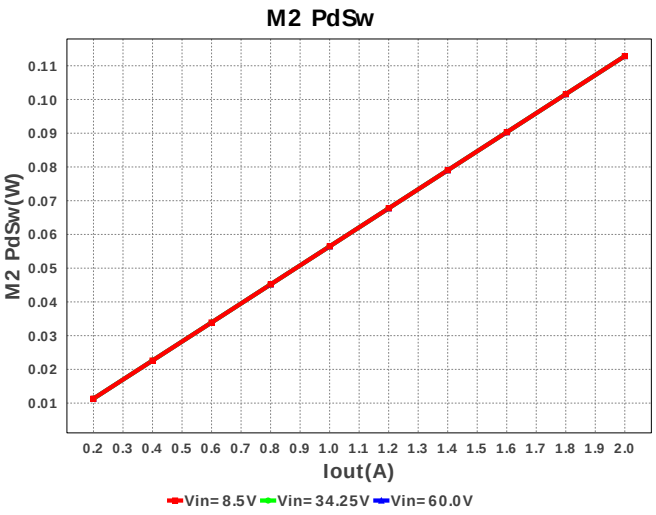
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	TDK	C1005X5R1A104K Series= 285	Cap= 100.0 nF ESR= 20.413 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3mm2
2.	Ccomp1	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
3.	Ccomp2	Yageo America	CC0805JRNP09BN180 Series= C0G/NP0	Cap= 18.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
4.	Cin	TDK	C5750X7S2A106M Series= 479	Cap= 10.0 µF ESR= 5.0 mOhm VDC= 100.0 V IRMS= 6.45 A	1	$0.84	2220 60mm2
5.	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
6.	Cout	MuRata	GRM21BR60J226ME39L Series= X5R	Cap= 22.0 µF ESR= 9.0 mOhm VDC= 6.3 V IRMS= 3.5 A	1	$0.03	0805 7mm2
7.	Cramp	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
8.	Cres	MuRata	GRM155C80G474KE01D Series= 379	Cap= 470.0 nF VDC= 4.0 V IRMS= 0.0 A	1	$0.01	0402 3mm2
9.	Css	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2

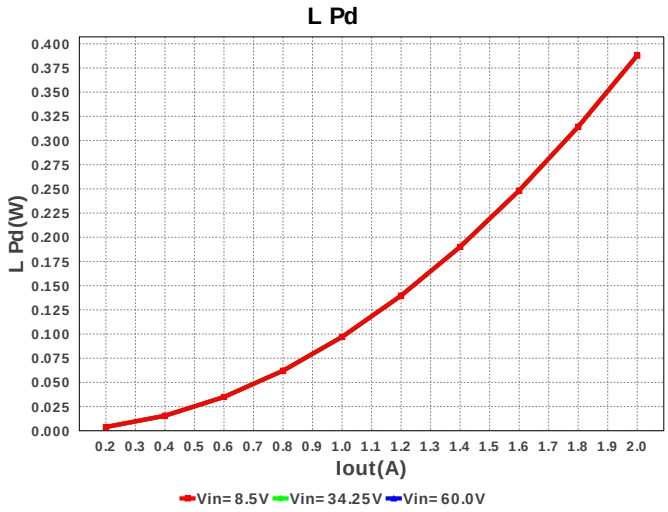
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cvcc	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3mm2
11.	D1	Diodes Inc.	DFLS1100-7	VF@Io= 770.0 mV VRRM= 100.0 V	1	$0.19	PowerDI123 13mm2
12.	L1	Coilcraft	XAL5050-153MEB	L= 15.0 µH DCR= 69.7 mOhm	1	$0.60	XAL5050 54mm2
13.	M1	Infineon Technologies	BSC340N08NS3 G	VdsMax= 80.0 V IdsMax= 23.0 Amps	1	$0.30	PG-TDSON-8 55mm2
14.	M2	Infineon Technologies	BSC340N08NS3 G	VdsMax= 80.0 V IdsMax= 23.0 Amps	1	$0.30	PG-TDSON-8 55mm2
15.	Rcomp	Vishay-Dale	CRCW04023K92FKED Series= CRCW..e3	Res= 3.92 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
16.	Rfb1	Vishay-Dale	CRCW04021K15FKED Series= CRCW..e3	Res= 1.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
17.	Rfb2	Vishay-Dale	CRCW04026K04FKED Series= CRCW..e3	Res= 6.04 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
18.	Rramp	Panasonic	ERJ-6ENF6042V Series= 225	Res= 60.4 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
19.	Rsense	Stackpole Electronics Inc	CSR1206FK30L0 Series= ?	Res= 30.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.10	1206 11mm2
20.	Rt	Vishay-Dale	CRCW040211K3FKED Series= CRCW..e3	Res= 11.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
21.	Ruv1	Vishay-Dale	CRCW040211K3FKED Series= CRCW..e3	Res= 11.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
22.	Ruv2	Panasonic	ERJ-6ENF5492V Series= 225	Res= 54.9 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
23.	U1	Texas Instruments	LM5117PMHX/NOPB	Switcher	1	$2.10	PWP0020A 71mm2

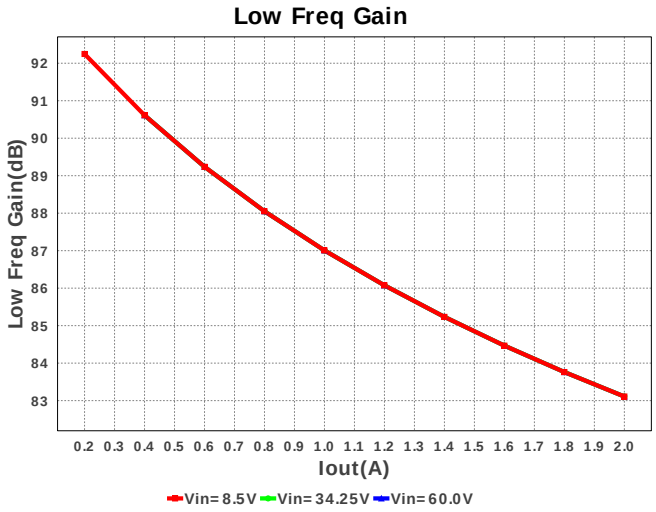


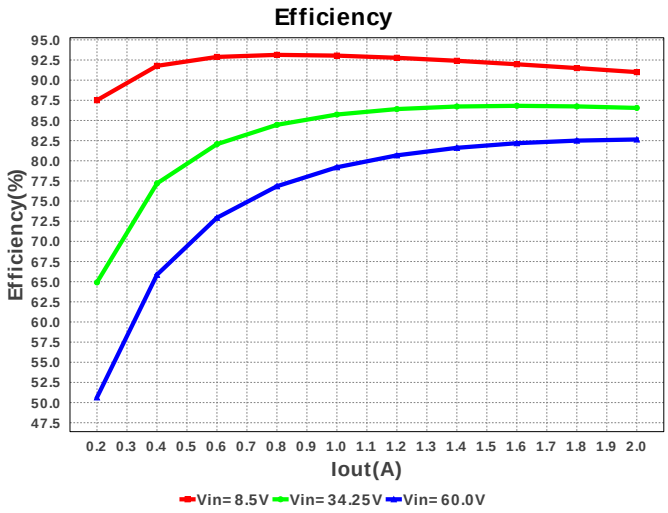


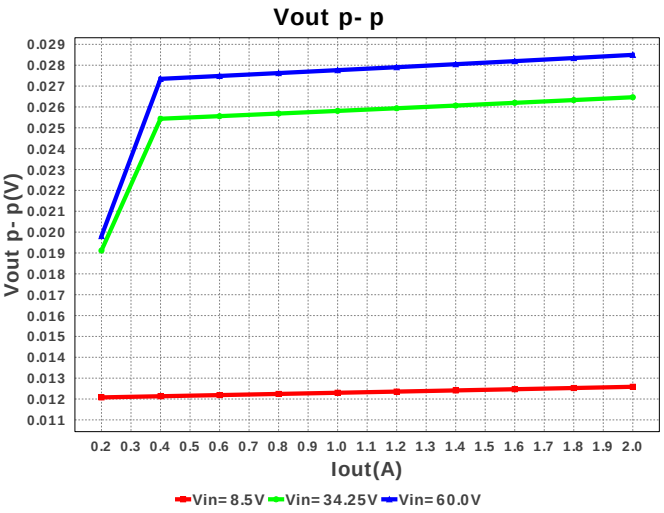


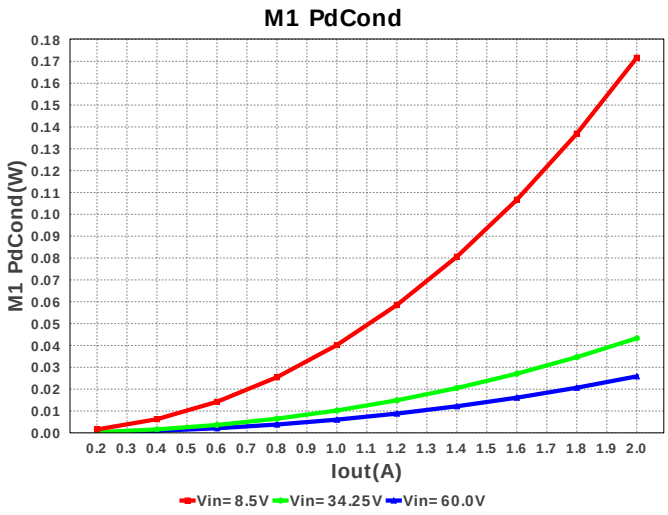


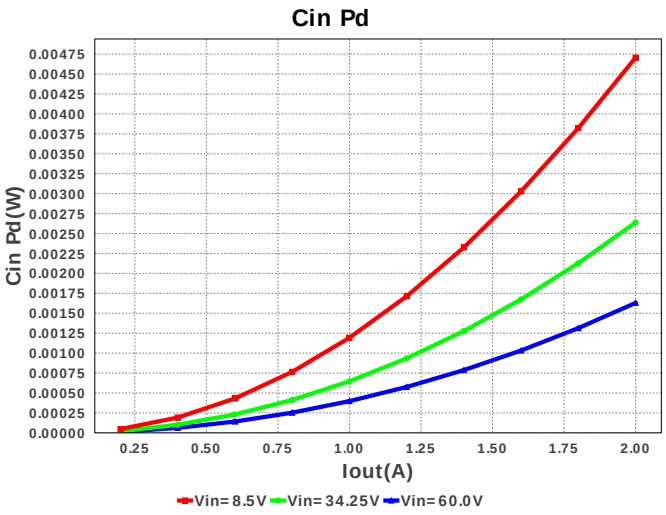


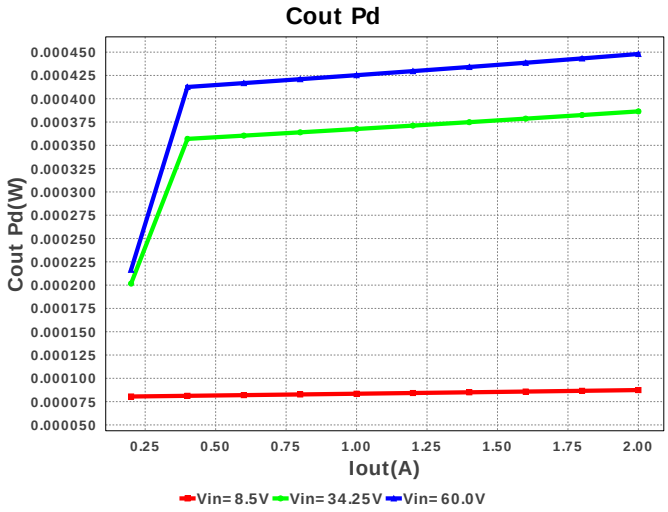


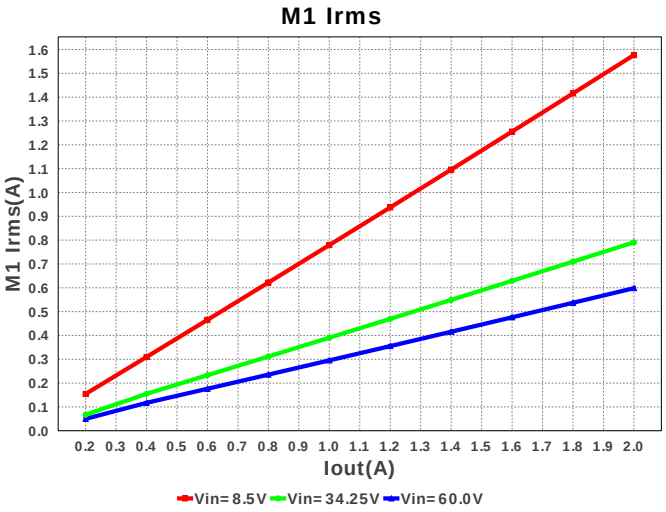


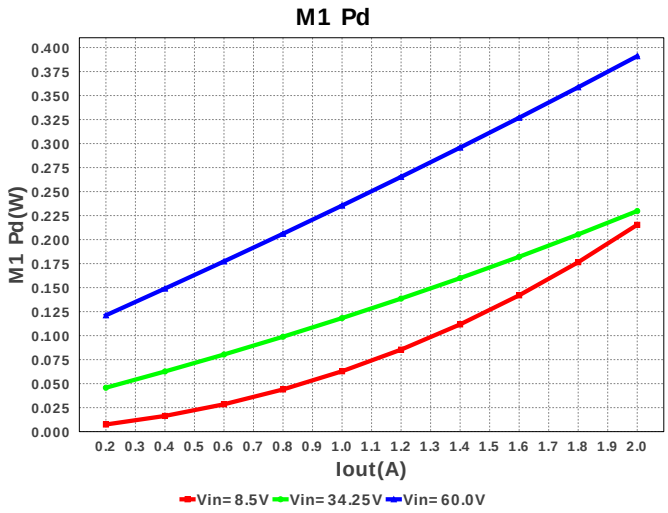


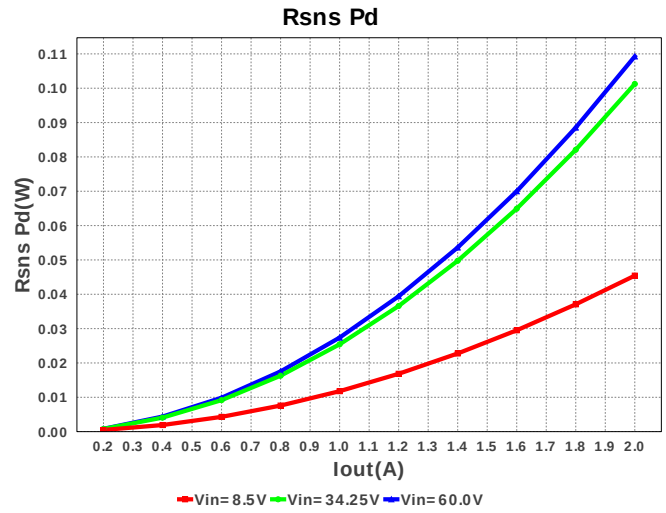


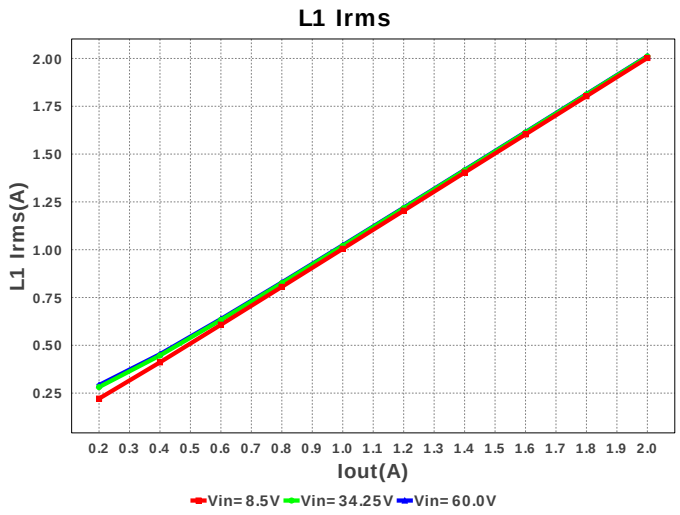


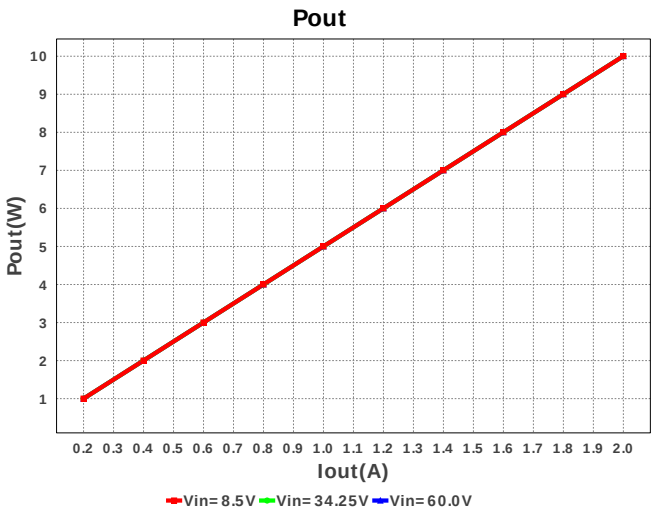


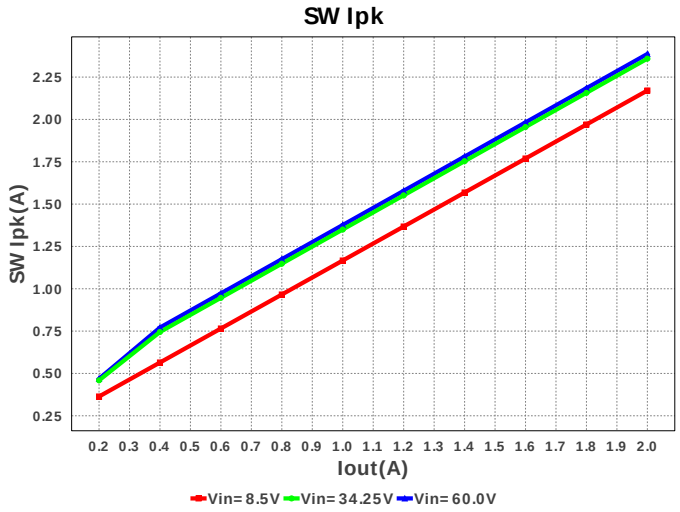


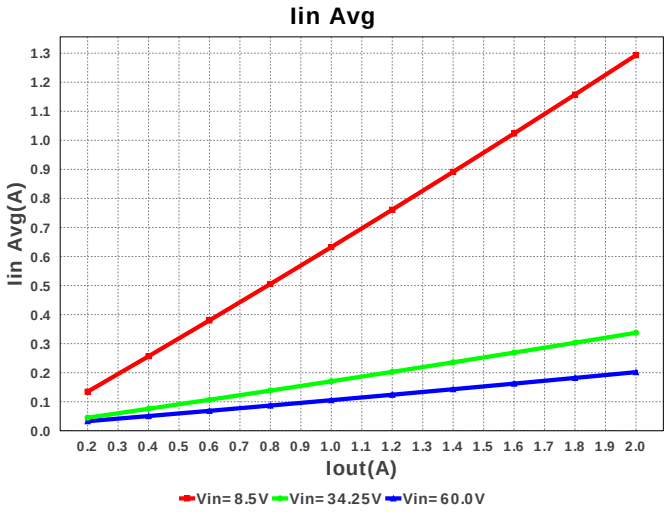


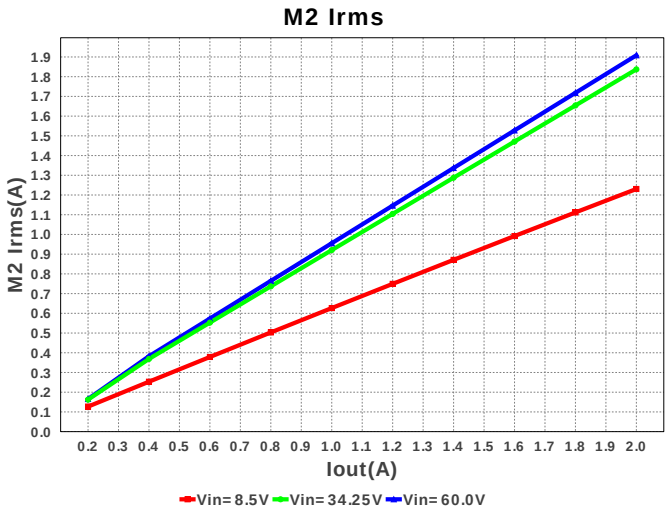


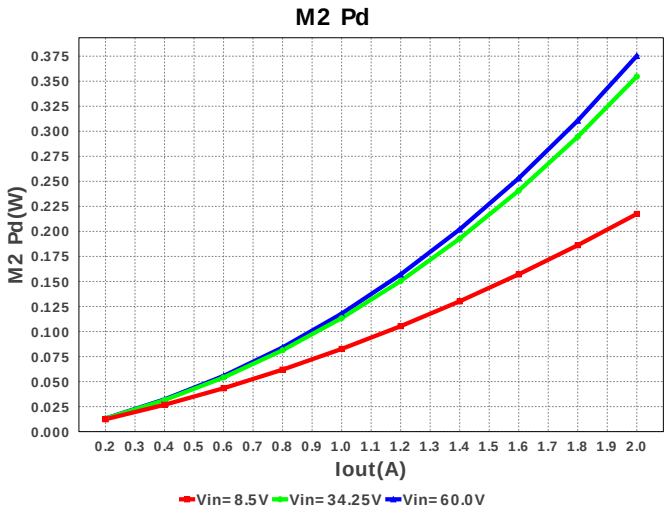


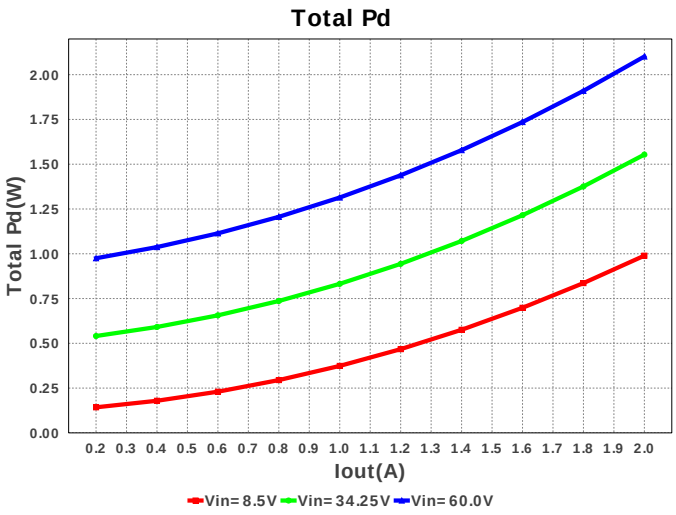


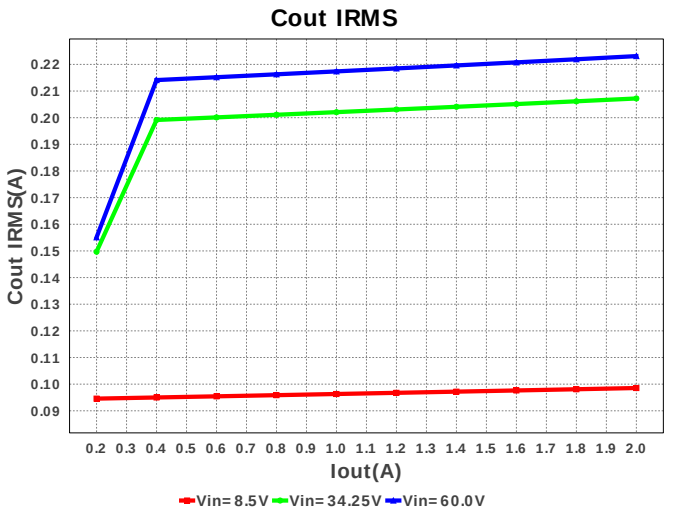


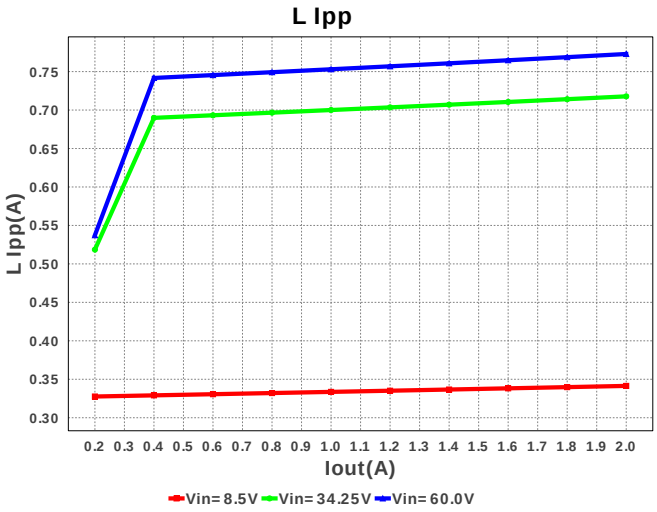


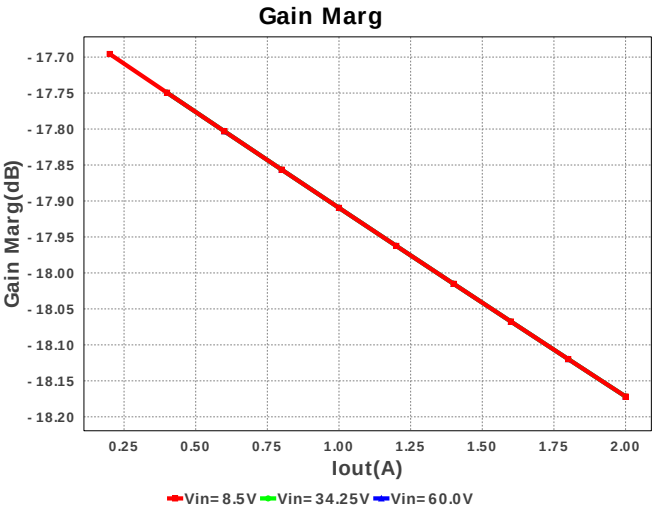


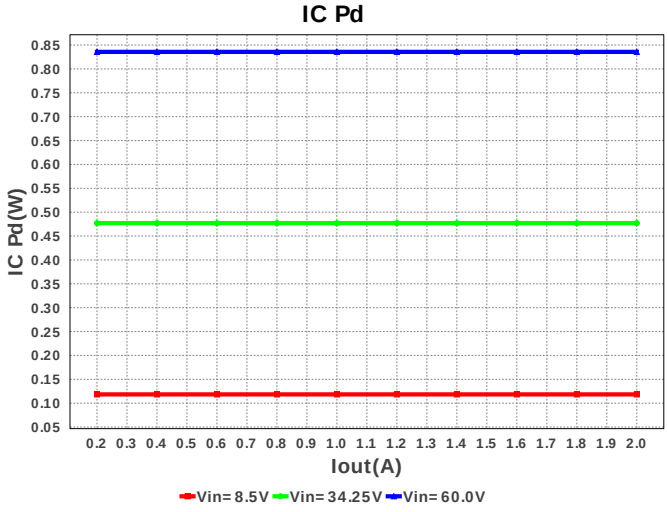


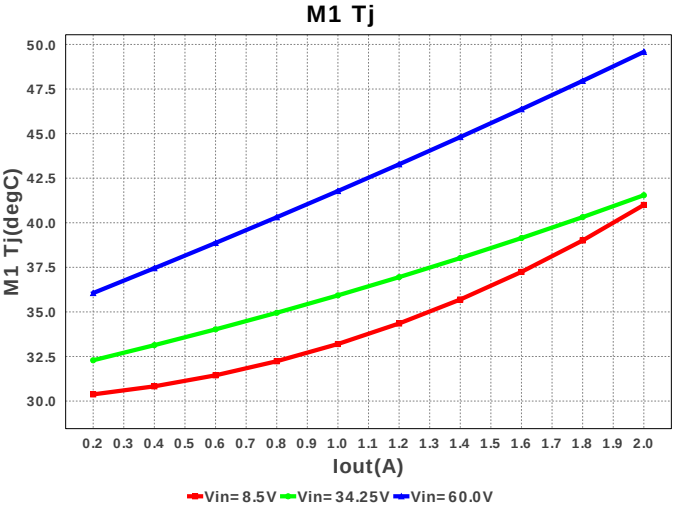


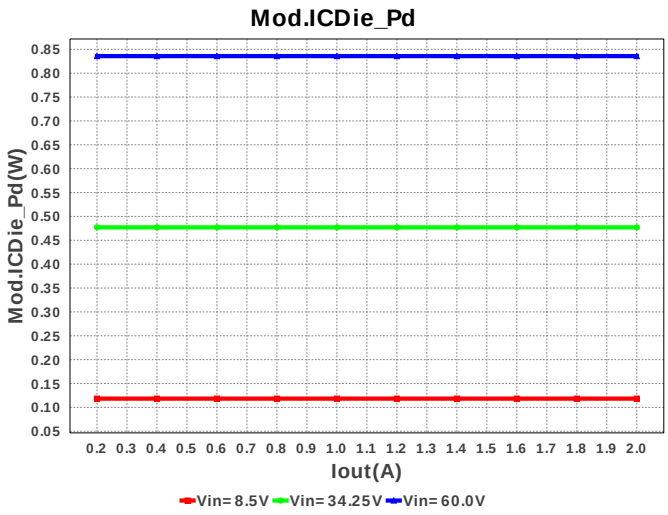


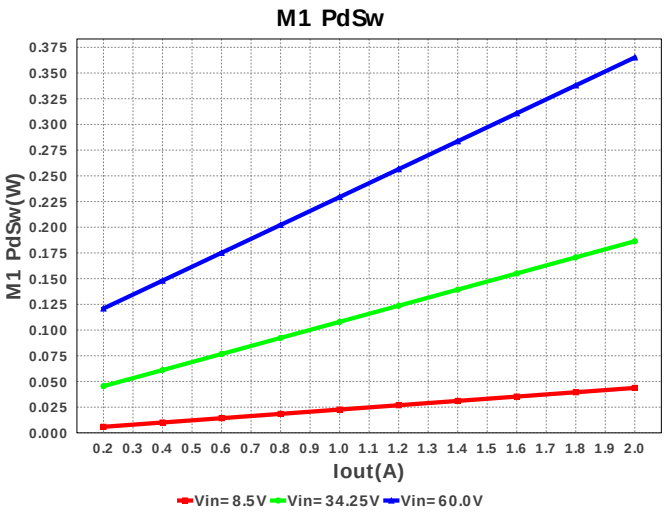


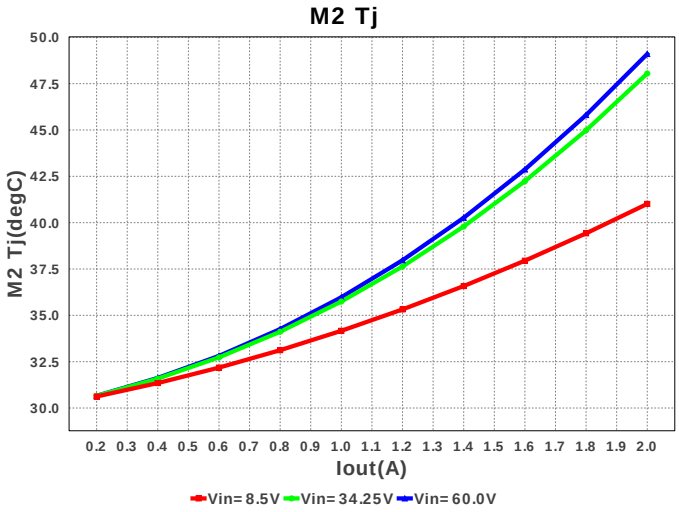


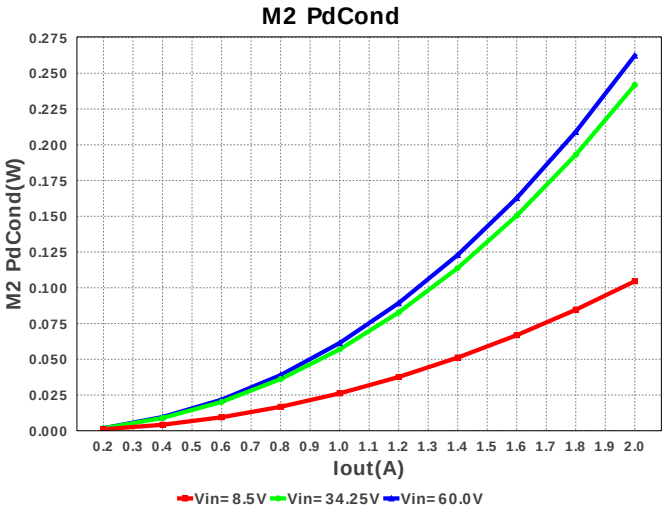


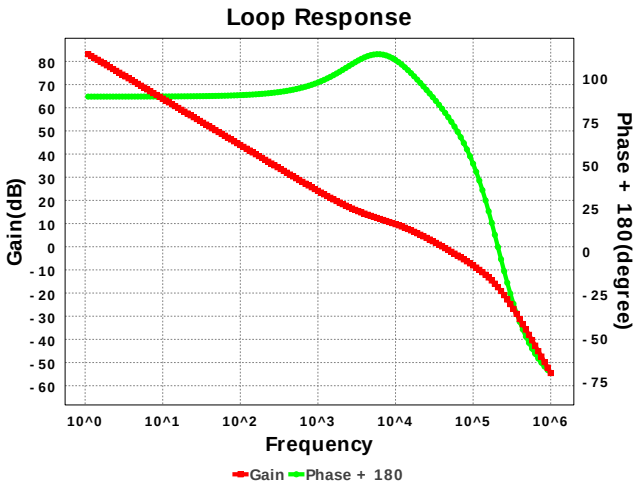












Operating Values

#	Name	Value	Category	Description
1.	Total BOM	$4.626		Total BOM Cost
2.	Cin IRMS	570.915 mA	Current	Input capacitor RMS ripple current
3.	Cout IRMS	223.115 mA	Current	Output capacitor RMS ripple current
4.	Iin Avg	201.75 mA	Current	Average input current
5.	L Ipp	772.894 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	2.012 A	Current	Inductor ripple current
7.	M1 Irms	598.315 mA	Current	MOSFET RMS ripple current
8.	M2 Irms	1.908 A	Current	MOSFET RMS ripple current
9.	SW Ipk	2.386 A	Current	Peak switch current
10.	BOM Count	2	General	Total Design BOM count
11.	FootPrint	398.0 mm2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Frequency	424.559 kHz	General	Switching frequency
13.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
14.	Pout	10.003 W	General	Total output power
15.	Vout OP	5.002 V	Op_Point	Operational Output Voltage
16.	Cross Freq	40.537 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	8.95 %	Op_point	Duty cycle
18.	Efficiency	82.641 %	Op_point	Steady state efficiency
19.	Gain Marg	-18.172 dB	Op_point	Bode Plot Gain Margin
20.	IC Tj	63.429 degC	Op_point	IC junction temperature
21.	IOUT_OP	2.0 A	Op_point	Iout operating point
22.	M1 Tj	49.584 degC	Op_point	M1 MOSFET junction temperature
23.	M2 Tj	49.1 degC	Op_point	M2 MOSFET junction temperature
24.	Phase Marg	82.508 deg	Op_point	Bode Plot Phase Margin
25.	VIN_OP	60.0 V	Op_point	Vin operating point
26.	Vout p-p	28.496 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	1.63 mW	Power	Input capacitor power dissipation
28.	Cout Pd	448.023 µW	Power	Output capacitor power dissipation
29.	IC Pd	835.728 mW	Power	IC power dissipation
30.	L Pd	387.956 mW	Power	Inductor power dissipation
31.	M1 Pd	391.017 mW	Power	M1 MOSFET total power dissipation
32.	M1 PdCond	25.857 mW	Power	M1 MOSFET conduction losses
33.	M1 PdSw	365.16 mW	Power	M1 MOSFET switching losses
34.	M2 Pd	375.273 mW	Power	M2 MOSFET total power dissipation
35.	M2 PdCond	262.413 mW	Power	M2 MOSFET conduction losses
36.	M2 PdSw	112.859 mW	Power	M2 MOSFET switching losses
37.	Rsns Pd	109.261 mW	Power	Current Limit Sense Resistor Power Dissipation
38.	Total Pd	2.101 W	Power	Total Power Dissipation
39.	Low Freq Gain	83.11 dB	Unknown	Gain at 10Hz

Design Inputs

#	Name	Value	Description
1.	Iout	2.0 A	Maximum Output Current
2.	Iout1	2.0 Amps	Output Current #1
3.	SoftStart	1.0 ms	Soft Start Time (ms)
4.	VinMax	60.0 V	Maximum input voltage
5.	VinMin	8.5 V	Minimum input voltage
6.	Vout	5.0 V	Output Voltage
7.	Vout1	5.0 Volt	Output Voltage #1
8.	base_pn	LM5117	Base Product Number
9.	source	DC	Input Source Type
10.	Ta	30.0 degC	Ambient temperature
11.	UserFsw	424.559 kHz	Customer Selected Frequency

Design Assistance

1. Outline The LM5117 is a 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. External Vcc An output voltage derived bias supply can be applied to the VCC pin to reduce the controller power dissipation at higher input voltage. This can also relax constraints on the driver supply current if your external source can supply more than the LM5117 internal regulator. Please see Datasheet for more information. 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 LM5117 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. **LM5117** Product Folder : http://www.ti.com/product/lm5117 : contains the data sheet and other resources.