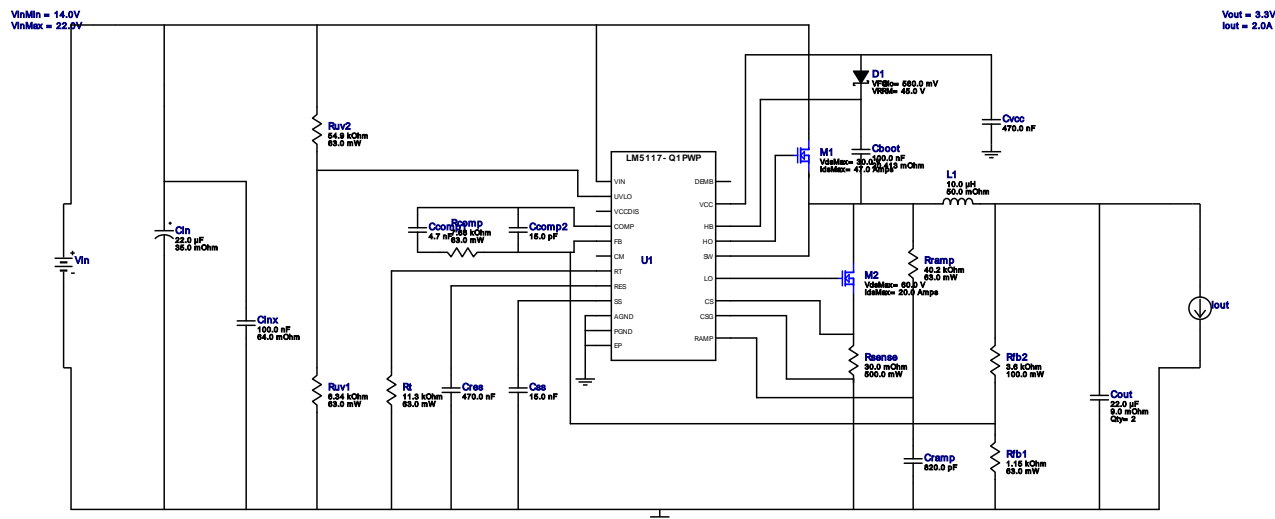


WEBENCH® Design Report

Design : 3839279/378 LM5117QPMH/NOPB
LM5117QPMH/NOPB 14.0V-22.0V to 3.30V @ 2.0A

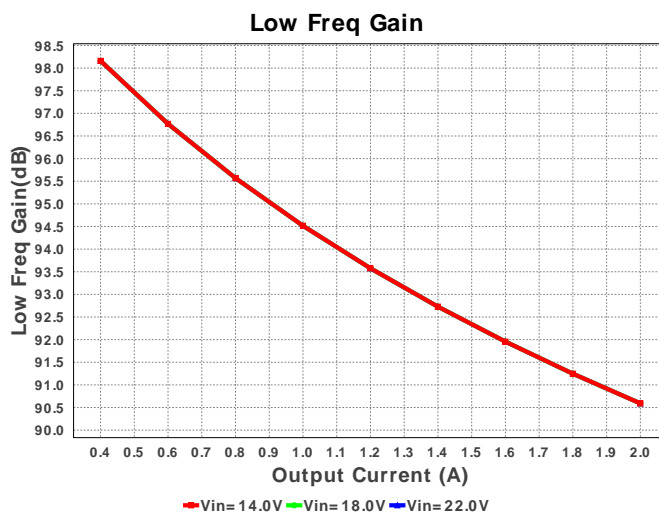
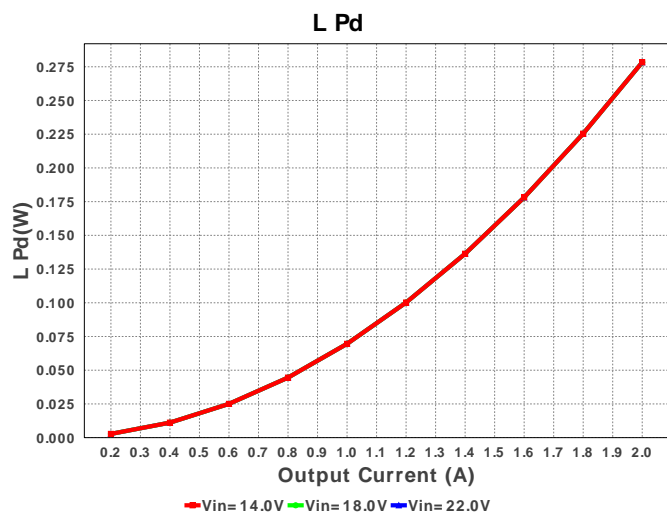
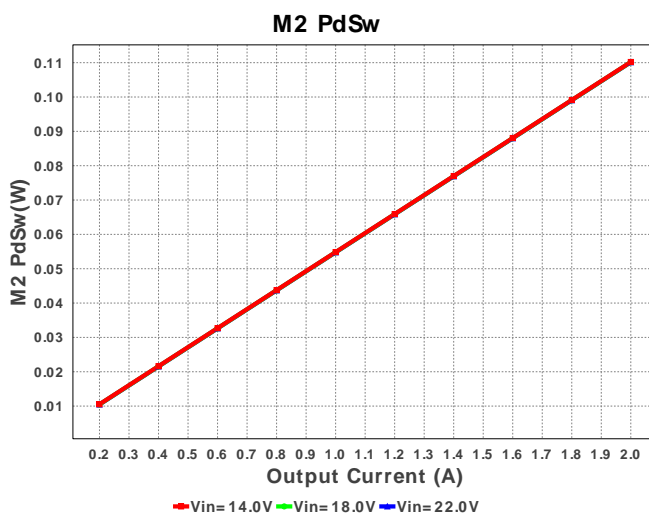
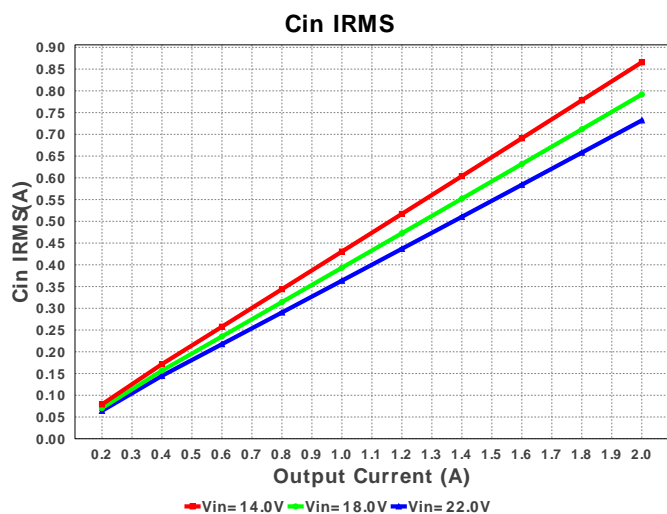
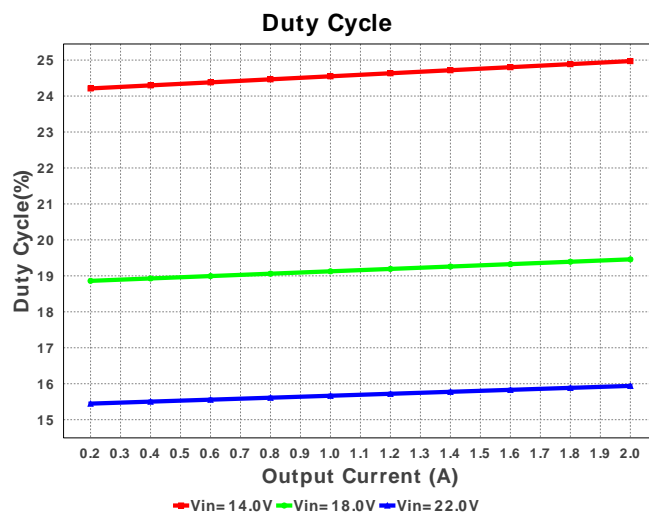
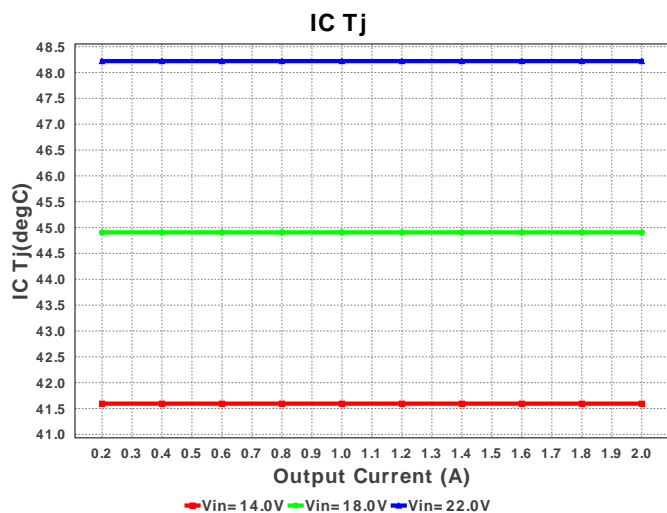


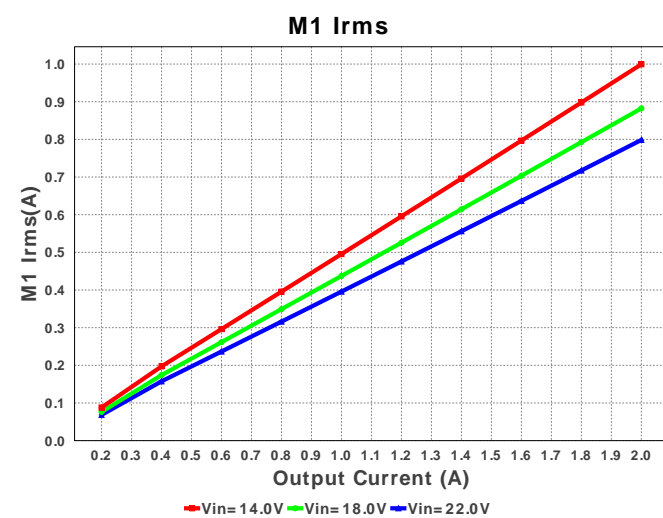
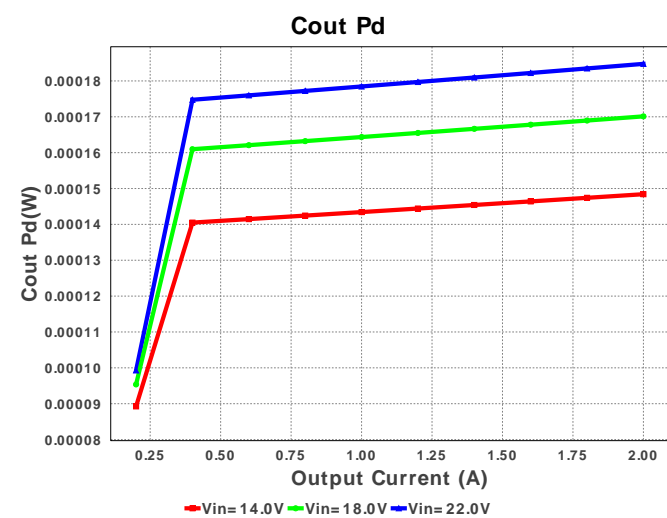
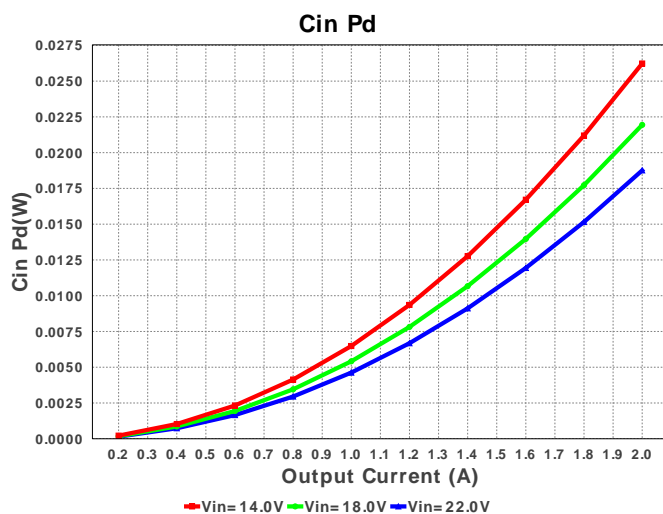
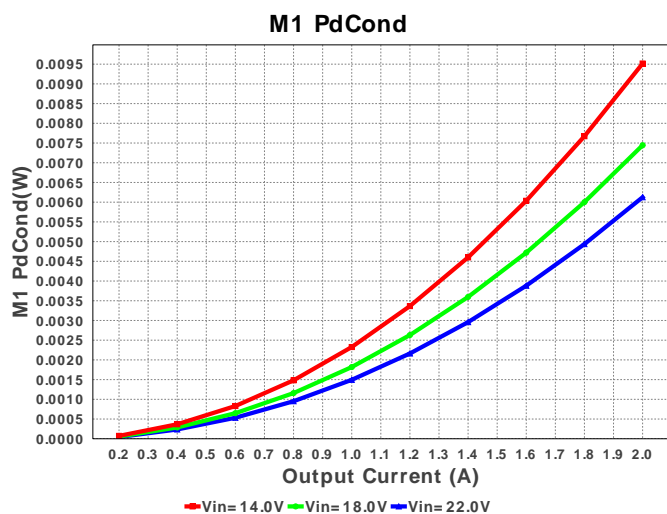
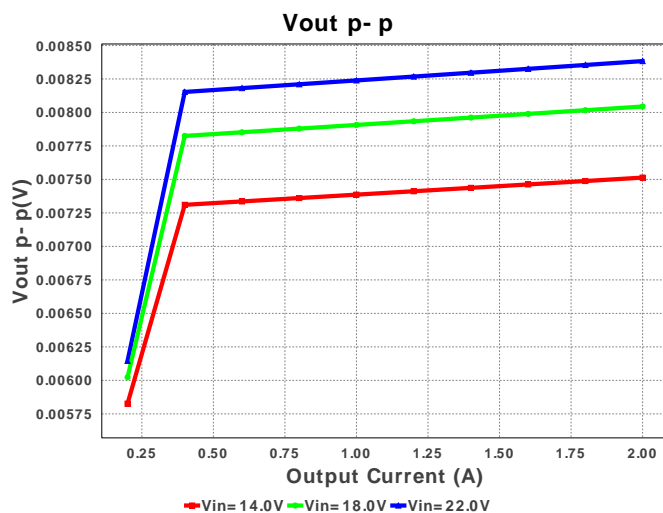
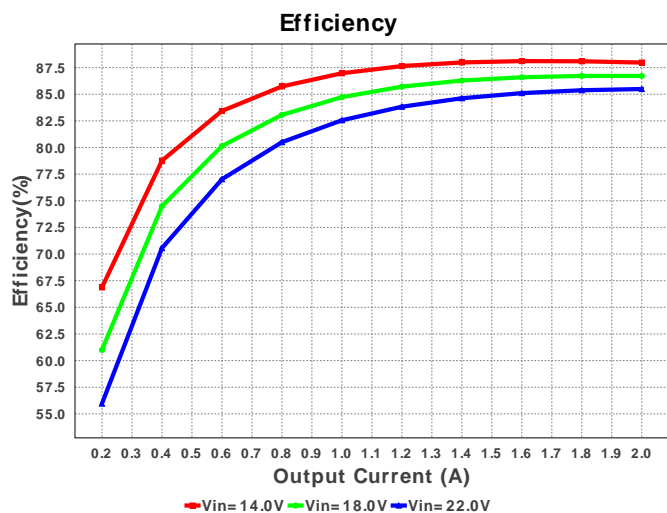
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

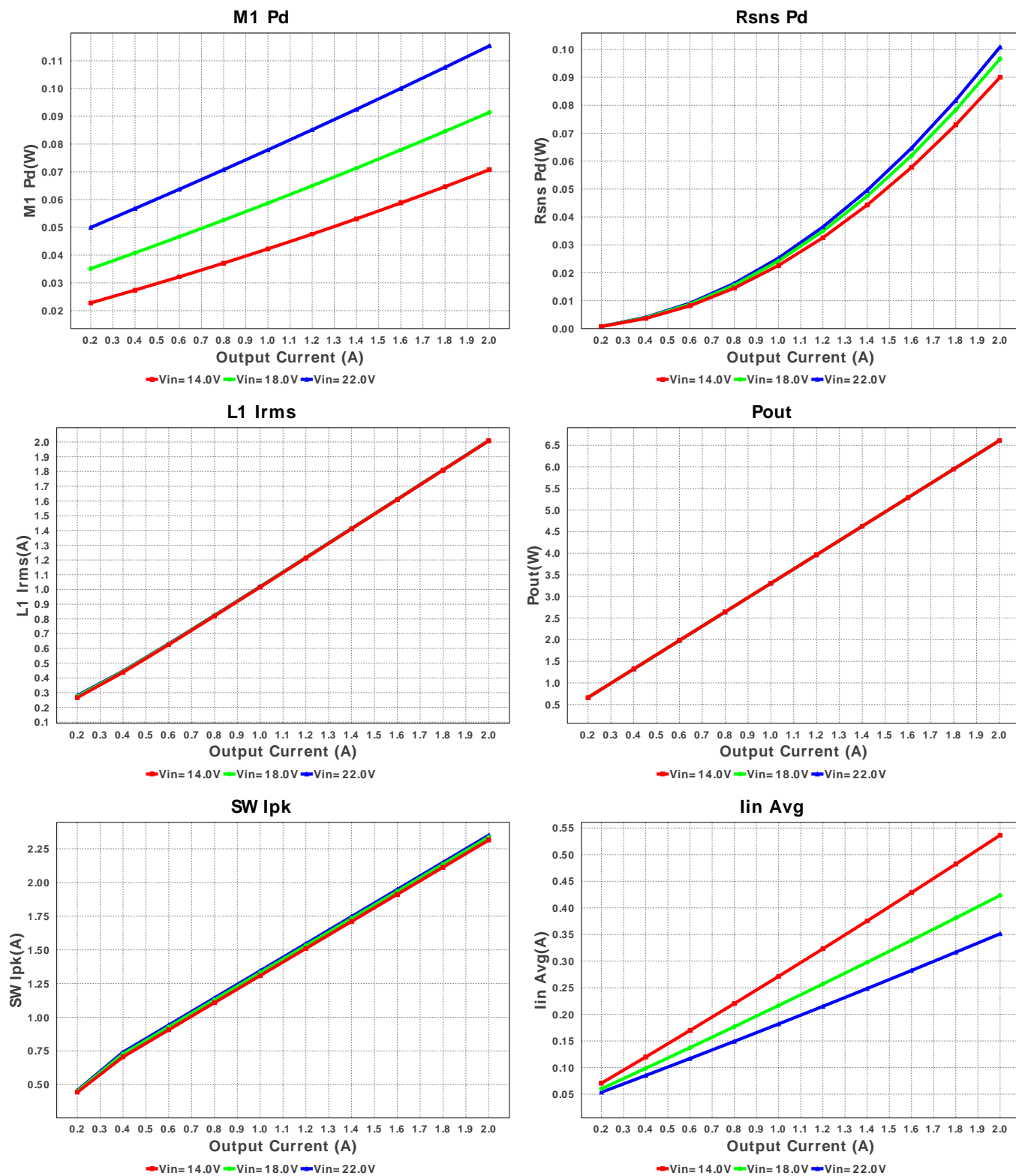
Electrical BOM

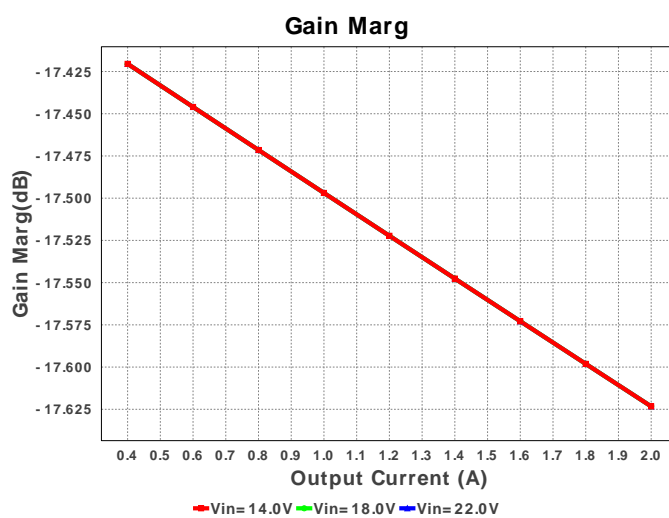
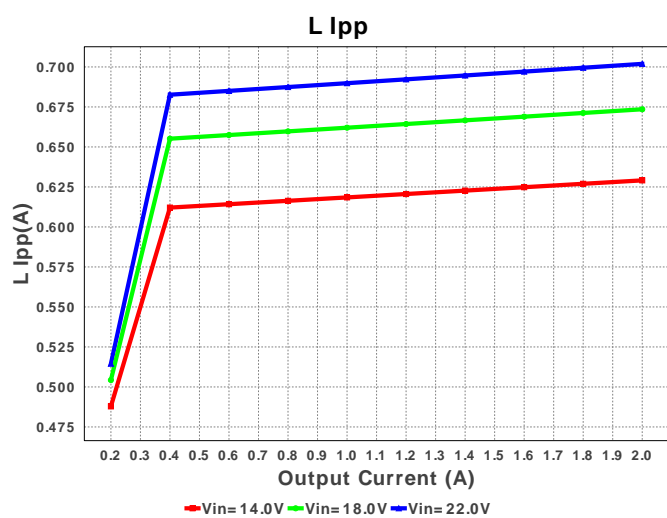
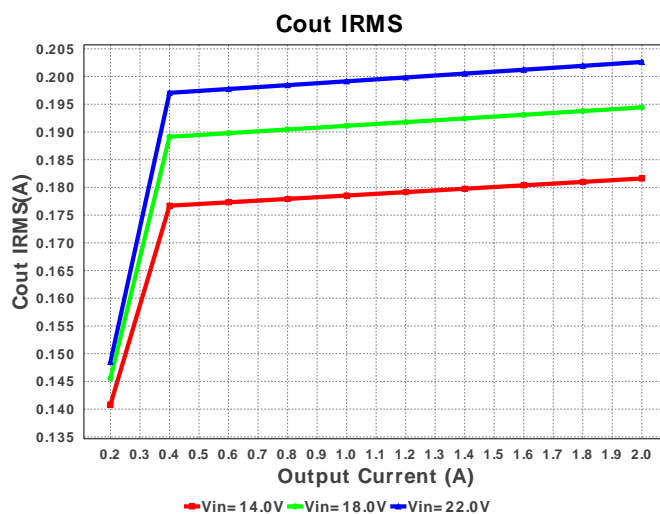
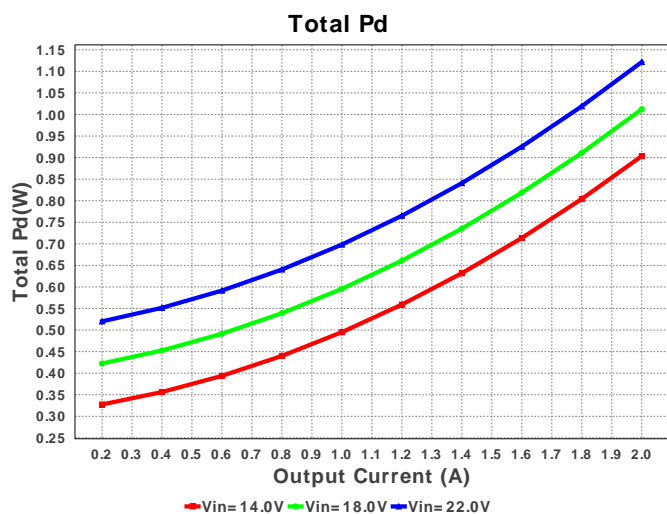
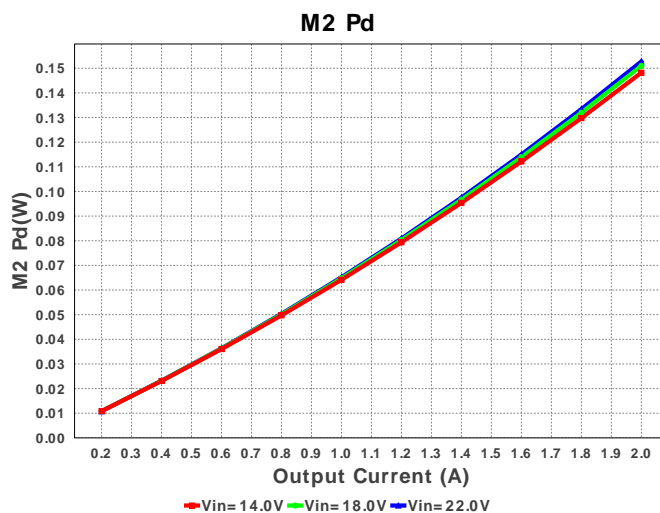
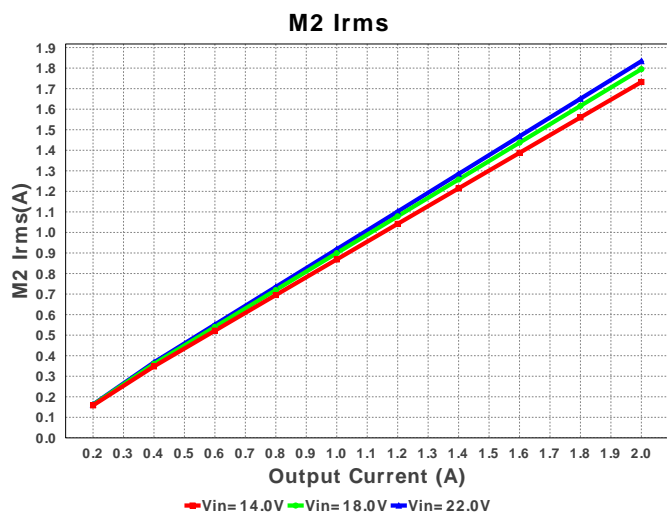
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	TDK	C1005X5R1A104K Series= X5R	Cap= 100.0 nF ESR= 20.413 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
2.	Ccomp1	Yageo America	CC0805KRX7R9BB472 Series= X7R	Cap= 4.7 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	Ccomp2	Yageo America	CC0805JRNPO9BN150 Series= C0G	Cap= 15.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Cin	Panasonic	35SVPF22M Series= 1273	Cap= 22.0 uF ESR= 35.0 mOhm VDC= 35.0 V IRMS= 2.6 A	1	\$0.43	CAPSMT_62_F61 74 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	MuRata	GRM21BR60J226ME39L Series= X5R	Cap= 22.0 uF ESR= 9.0 mOhm VDC= 6.3 V IRMS= 3.5 A	2	\$0.05	0805 7 mm ²
7.	Cramp	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
8.	Cres	MuRata	GRM155C80G474KE01D Series= 379	Cap= 470.0 nF VDC= 4.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²

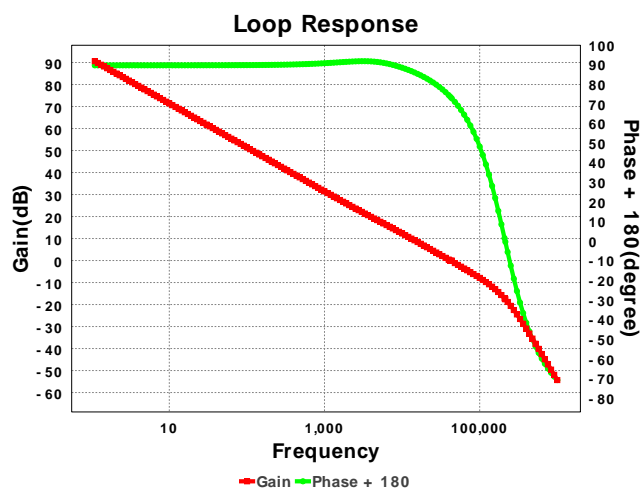
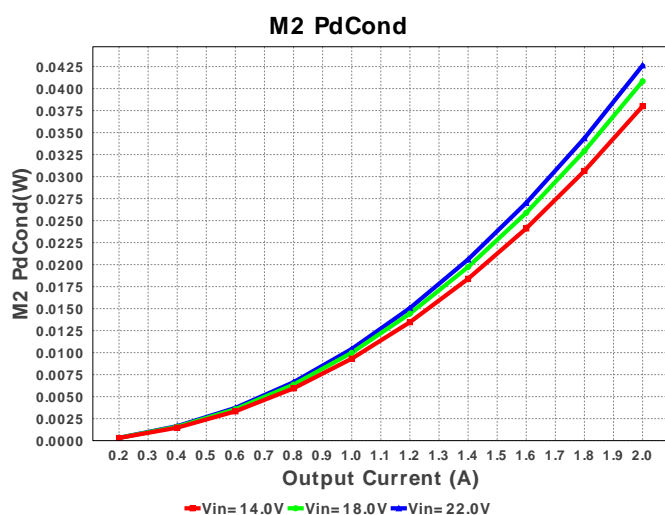
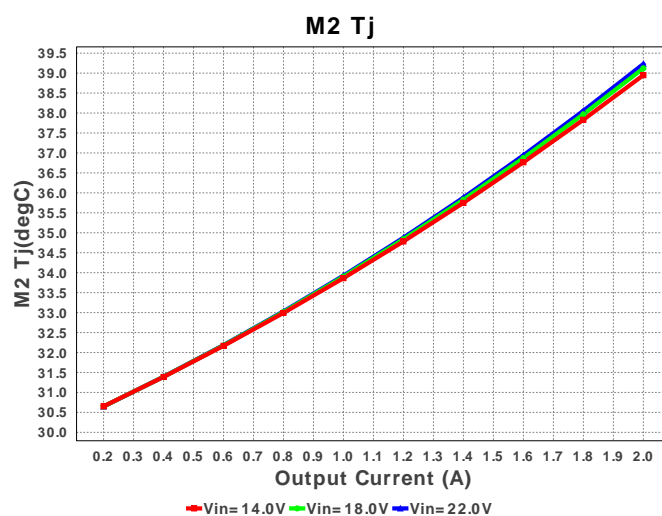
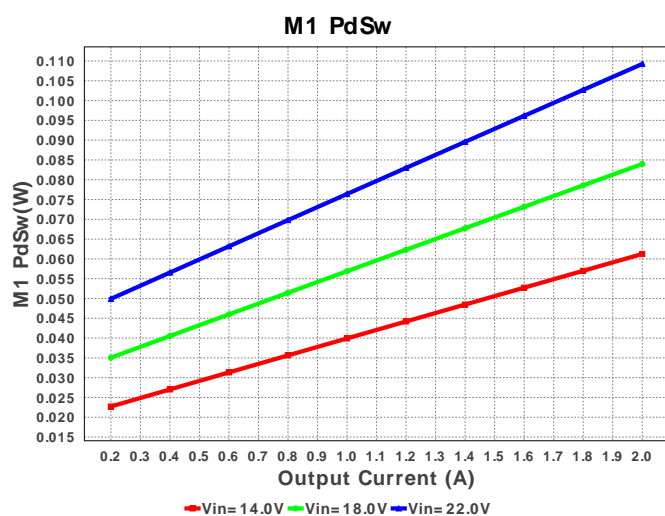
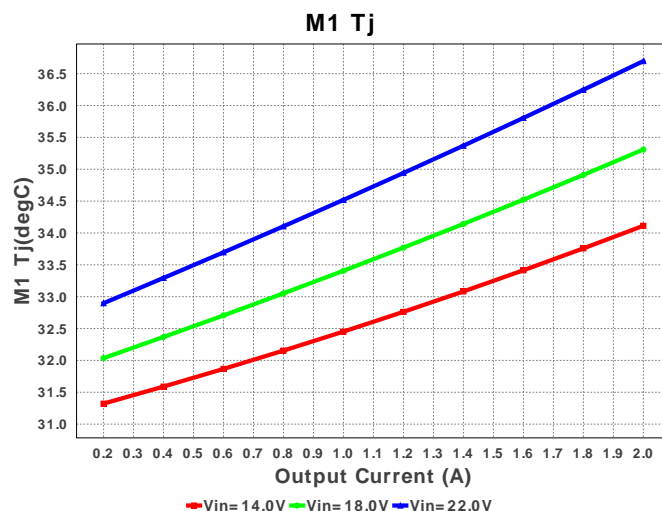
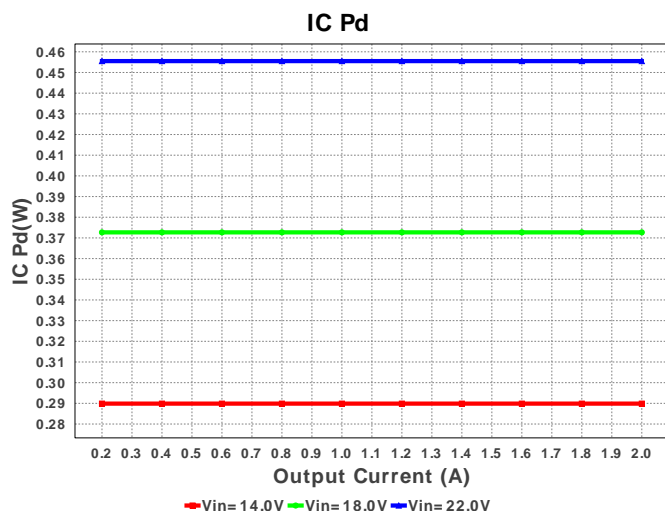
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Css	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
10.	Cvcc	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
11.	D1	Diodes Inc.	SDM10U45-7-F	VF@Io= 580.0 mV VRRM= 45.0 V	1	\$0.06	 SOD-523 5 mm ²
12.	L1	Bourns	SRN8040-100M	L= 10.0 µH DCR= 50.0 mOhm	1	\$0.22	 SRN8040 100 mm ²
13.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 47.0 Amps	1	\$0.34	 TRANS_NexFET_Q3 19 mm ²
14.	M2	Infineon Technologies	BSZ067N06LS3 G	VdsMax= 60.0 V IdsMax= 20.0 Amps	1	\$0.43	 PG-TSDSON-8 19 mm ²
15.	Rcomp	Vishay-Dale	CRCW04027K68FKED Series= CRCW..e3	Res= 7.68 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
16.	Rfb1	Vishay-Dale	CRCW04021K15FKED Series= CRCW..e3	Res= 1.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	Rfb2	Susumu Co Ltd	RR1220P-362-D Series= 264	Res= 3.6 kOhm Power= 100.0 mW Tolerance= 0.5%	1	\$0.01	 0805 7 mm ²
18.	Rramp	Vishay-Dale	CRCW040240K2FKED Series= CRCW..e3	Res= 40.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
19.	Rsense	Stackpole Electronics Inc	CSR1206FK30L0 Series= ?	Res= 30.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.10	 1206 11 mm ²
20.	Rt	Vishay-Dale	CRCW040211K3FKED Series= CRCW..e3	Res= 11.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Ruv1	Vishay-Dale	CRCW04026K34FKED Series= CRCW..e3	Res= 6.34 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	Ruv2	Vishay-Dale	CRCW040254K9FKED Series= CRCW..e3	Res= 54.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
23.	U1	Texas Instruments	LM5117QPMH/NOPB	Switcher	1	\$2.82	 PWP0020A 71 mm ²











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	732.095 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	202.627 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	351.49 mA	Current	Average input current
4.	L Ipp	701.92 mA	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	2.01 A	Current	Inductor ripple current
6.	M1 Irms	798.495 mA	Current	MOSFET RMS ripple current
7.	M2 Irms	1.834 A	Current	MOSFET RMS ripple current
8.	SW Ipk	2.351 A	Current	Peak switch current
9.	BOM Count	24	General	Total Design BOM count
10.	FootPrint	381.0 mm ²	General	Total Foot Print Area of BOM components
11.	Frequency	424.559 kHz	General	Switching frequency

#	Name	Value	Category	Description
12.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
13.	Pout	6.609 W	General	Total output power
14.	Total BOM	\$4.65	General	Total BOM Cost
15.	Vout OP	3.304 V	Op_Point	Operational Output Voltage
16.	Cross Freq	41.98 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	15.94 %	Op_point	Duty cycle
18.	Efficiency	85.462 %	Op_point	Steady state efficiency
19.	Gain Marg	-17.611 dB	Op_point	Bode Plot Gain Margin
20.	IC Tj	48.318 degC	Op_point	IC junction temperature
21.	IOUT_OP	2.0 A	Op_point	Iout operating point
22.	M1 Tj	36.697 degC	Op_point	M1 MOSFET junction temperature
23.	M2 Tj	39.229 degC	Op_point	M2 MOSFET junction temperature
24.	Phase Marg	73.901 deg	Op_point	Bode Plot Phase Margin
25.	VIN_OP	22.0 V	Op_point	Vin operating point
26.	Vout p-p	8.392 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	18.759 mW	Power	Input capacitor power dissipation
28.	Cout Pd	184.759 μ W	Power	Output capacitor power dissipation
29.	IC Pd	457.939 mW	Power	IC power dissipation
30.	L Pd	278.304 mW	Power	Inductor power dissipation
31.	M1 Pd	115.367 mW	Power	M1 MOSFET total power dissipation
32.	M1 PdCond	6.125 mW	Power	M1 MOSFET conduction losses
33.	M1 PdSw	109.241 mW	Power	M1 MOSFET switching losses
34.	M2 Pd	152.756 mW	Power	M2 MOSFET total power dissipation
35.	M2 PdCond	42.638 mW	Power	M2 MOSFET conduction losses
36.	M2 PdSw	110.119 mW	Power	M2 MOSFET switching losses
37.	Rsns Pd	100.872 mW	Power	Current Limit Sense Resistor Power Dissipation
38.	Total Pd	1.124 W	Power	Total Power Dissipation
39.	Low Freq Gain	90.591 dB	Unknown	Gain at 10Hz

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	Iout1	2.0	Output Current #1
3.	VinMax	22.0	Maximum input voltage
4.	VinMin	14.0	Minimum input voltage
5.	Vout	3.3	Output Voltage
6.	Vout1	3.3	Output Voltage #1
7.	base_pn	LM5117-Q1	Texas Instruments Base Part Number
8.	source	DC	Input Source Type
9.	ta	30.0	Ambient temperature

Design Assistance

1. Feature Highlights: Automotive Qualified 4.5V to 18V Vin, 3A Synchronous Buck DCAP2 Mode Converter
2. The LM5117-Q1 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
3. Outline The LM5117-Q1 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-Q1 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-Q1 provides a diode emulation feature that can be enabled to prevent reverse (drain to source) current flow in the low side free-wheel MOSFET.
4. LM5117-Q1 Product Folder : <http://www.ti.com/product/lm5117%2Dq1> : contains the data sheet and other resources.

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