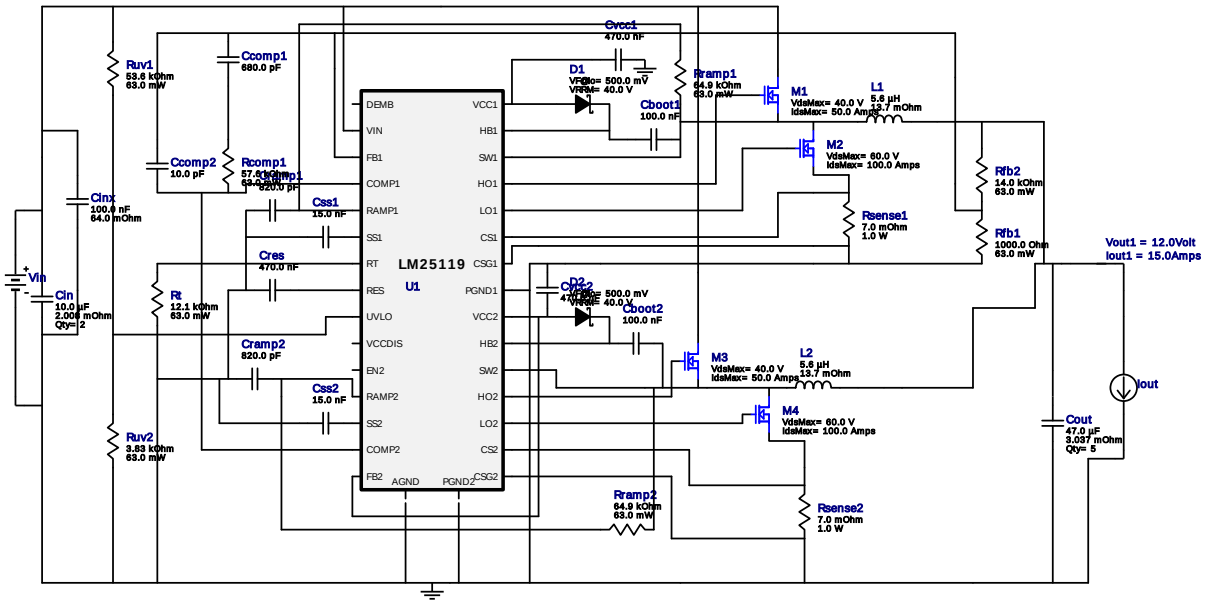
WEBENCH® Design Report

VinMin = 23.0V
VinMax = 25.0V
Vout = 12.0V
Iout = 15.0A

Device = LM25119PSQ/NOPB
Topology = Buck
Created = 2/1/16 7:52:19 AM
BOM Cost = $10.08
BOM Count = 38
Total Pd = 6.96W

Design : 4079392/15 LM25119PSQ/NOPB
LM25119PSQ/NOPB 23.0V-25.0V to 12.00V @ 15.0A



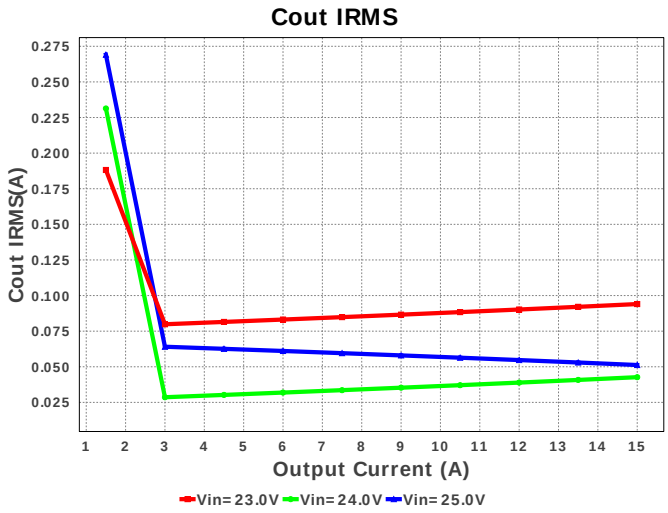
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

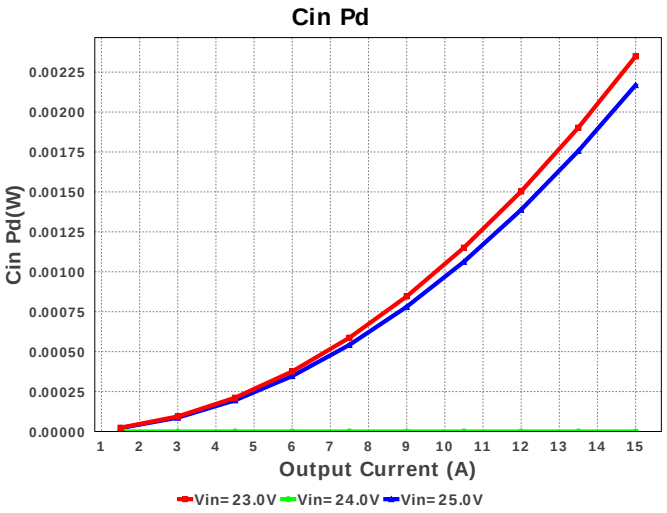
Electrical BOM

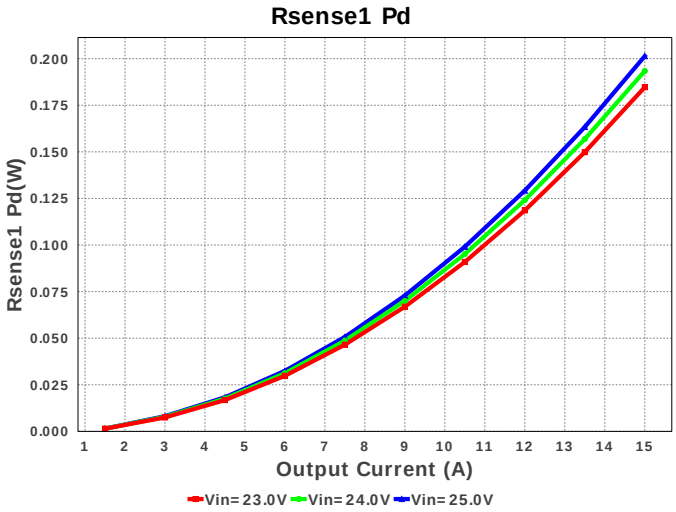
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot1	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cboot2	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
3.	Ccomp1	Yageo America	CC0805KRX7R9BB681 Series= X7R	Cap= 680.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Ccomp2	Kemet	C0805C100K5GACTU Series= C0G/NP0	Cap= 10.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Cin	MuRata	GRM32ER7YA106KA12L Series= X7R	Cap= 10.0 uF ESR= 2.008 mOhm VDC= 35.0 V IRMS= 4.6772 A	2	$0.25	1210_280 15 mm²
6.	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 mm²
7.	Cout	MuRata	GRM32ER61C476ME15L Series= X5R	Cap= 47.0 uF ESR= 3.037 mOhm VDC= 16.0 V IRMS= 4.59346 A	5	$0.24	1210_280 15 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

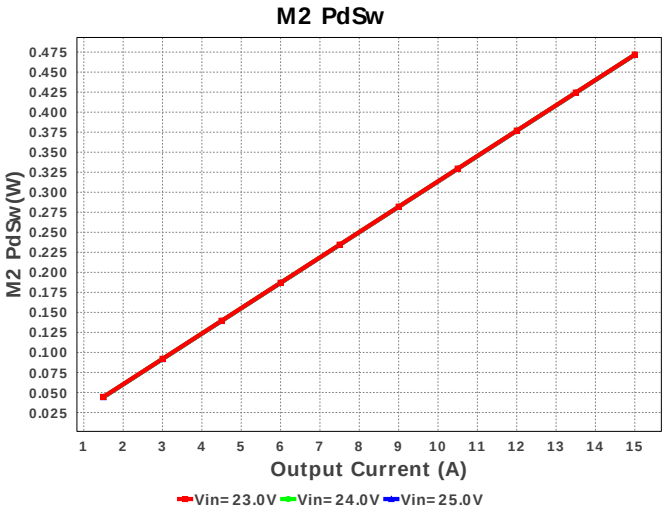
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cramp2	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
10.	Cres	MuRata	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
11.	Css1	Yageo America	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	Diodes Inc.	B240A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.09	 SMA 37 mm²
16.	D2	Diodes Inc.	B240A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.09	 SMA 37 mm²
17.	L1	Coilcraft	XAL7070-562MEB	L= 5.6 µH DCR= 13.7 mOhm	1	$1.05	 XAL7070 87 mm²
18.	L2	Coilcraft	XAL7070-562MEB	L= 5.6 µH DCR= 13.7 mOhm	1	$1.05	 XAL7070 87 mm²
19.	M1	Texas Instruments	CSD18504Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.56	 TRANS_NexFET_Q5A 55 mm²
20.	M2	Texas Instruments	CSD18531Q5A	VdsMax= 60.0 V IdsMax= 100.0 Amps	1	$0.90	 TRANS_NexFET_Q5A 55 mm²
21.	M3	Texas Instruments	CSD18504Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.56	 TRANS_NexFET_Q5A 55 mm²
22.	M4	Texas Instruments	CSD18531Q5A	VdsMax= 60.0 V IdsMax= 100.0 Amps	1	$0.90	 TRANS_NexFET_Q5A 55 mm²
23.	Rcomp1	Vishay-Dale	CRCW040257K6FKED Series= CRCW..e3	Res= 57.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
24.	Rfb1	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
25.	Rfb2	Vishay-Dale	CRCW040214K0FKED Series= CRCW..e3	Res= 14.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
26.	Rramp1	Vishay-Dale	CRCW040264K9FKED Series= CRCW..e3	Res= 64.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

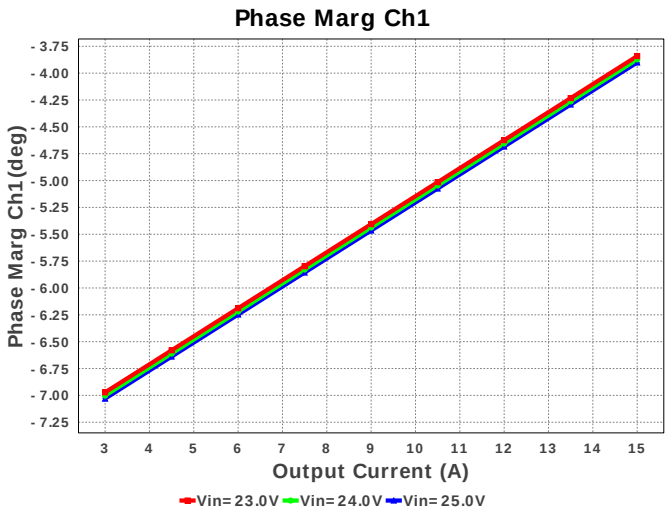
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	Rramp2	Vishay-Dale	CRCW040264K9FKED Series= CRCW..e3	Res= 64.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
28.	Rsense1	Susumu Co Ltd	PRL1632-R007-F-T1 Series= PRL1632	Res= 7.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	0612 11 mm²
29.	Rsense2	Susumu Co Ltd	PRL1632-R007-F-T1 Series= PRL1632	Res= 7.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	0612 11 mm²
30.	Rt	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
31.	Ruv1	Vishay-Dale	CRCW040253K6FKED Series= CRCW..e3	Res= 53.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
32.	Ruv2	Vishay-Dale	CRCW04023K83FKED Series= CRCW..e3	Res= 3.83 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
33.	U1	Texas Instruments	LM25119PSQ/NOPB	Switcher	1	$2.60	SQA32A 49 mm²

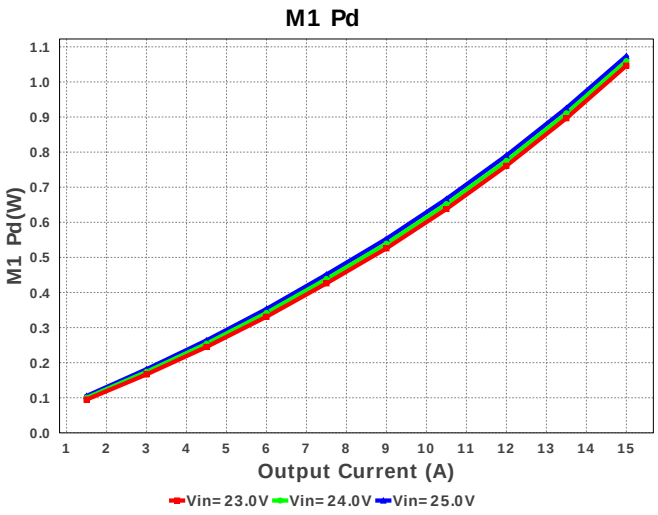


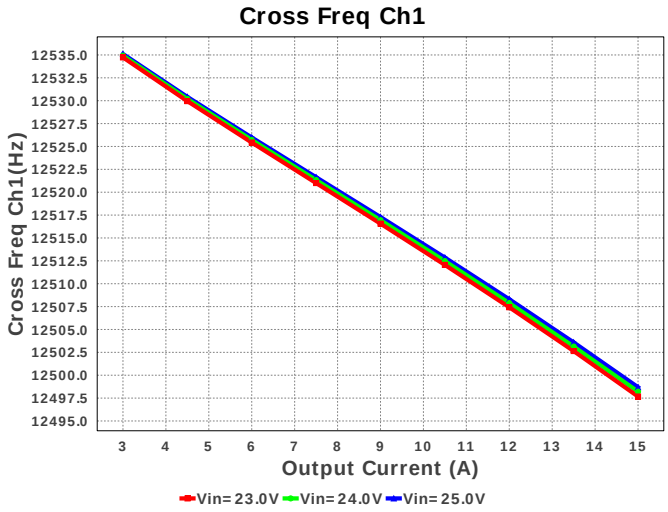


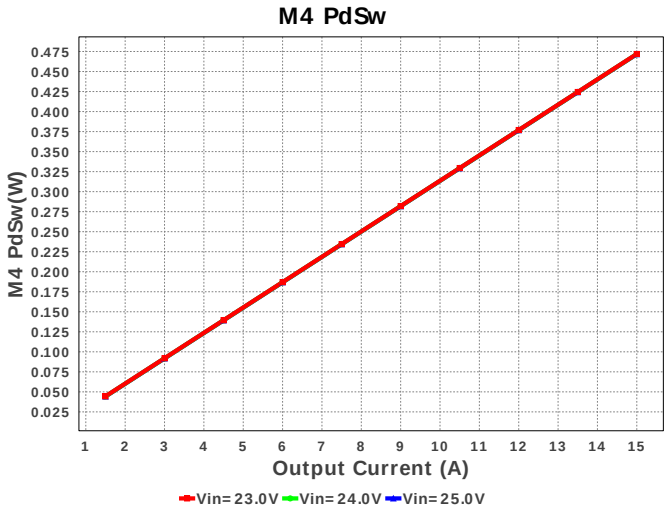


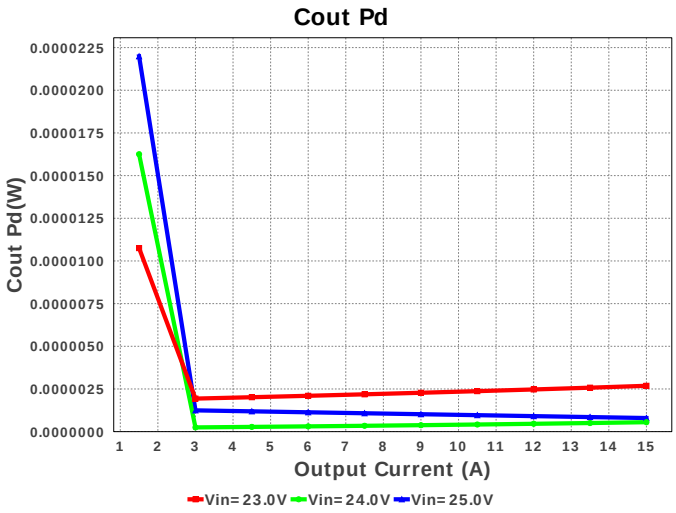


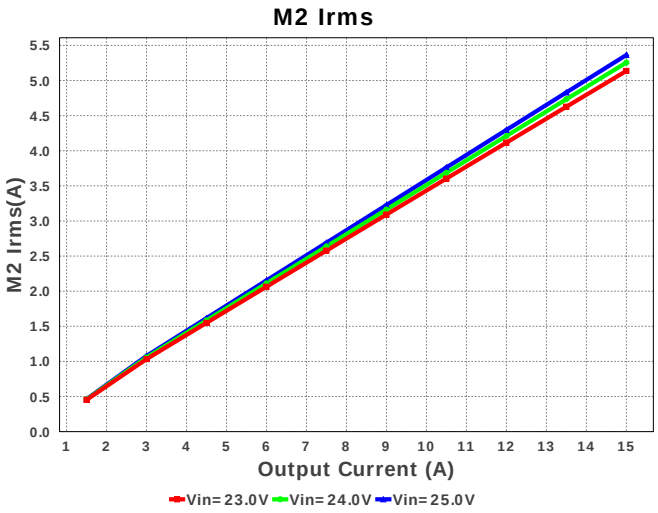


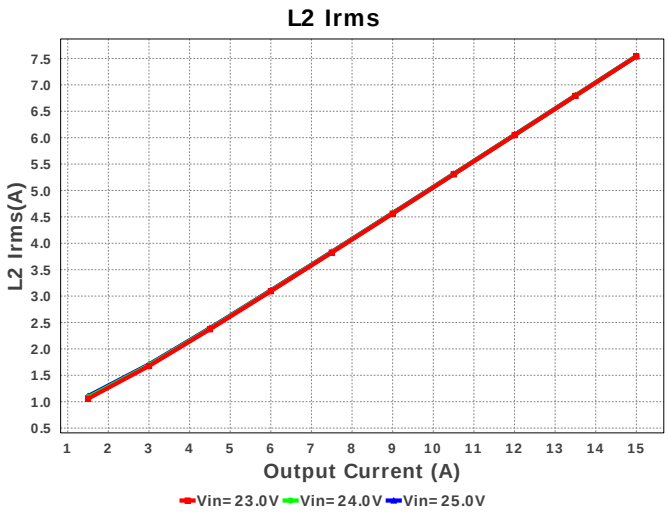


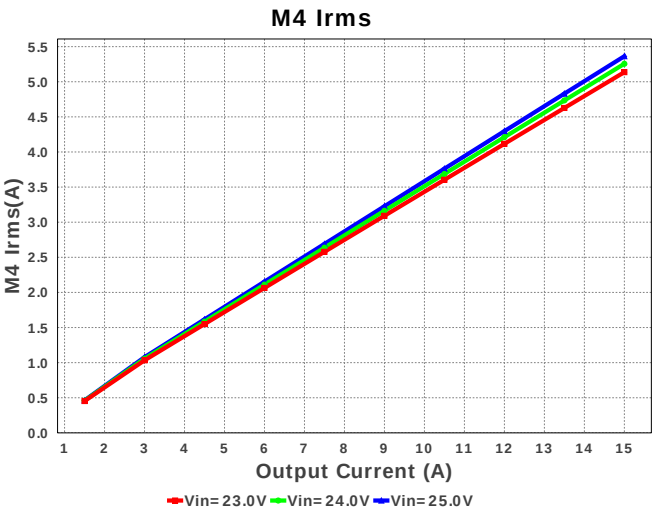


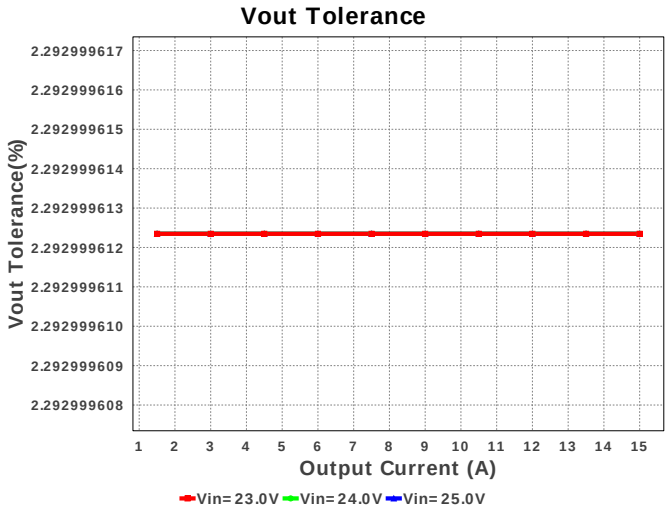


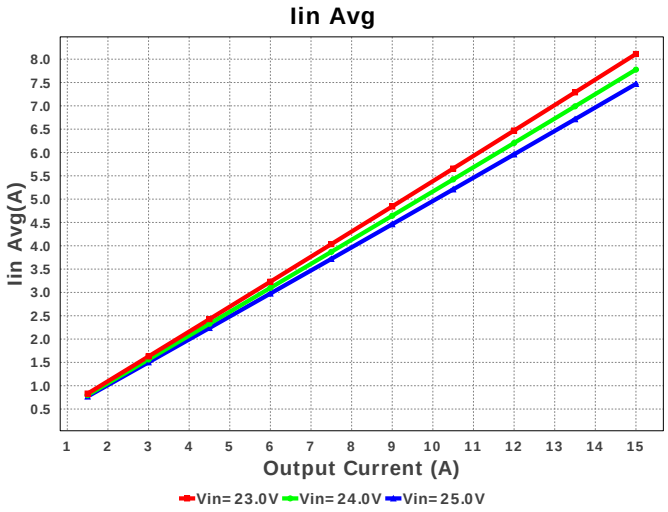


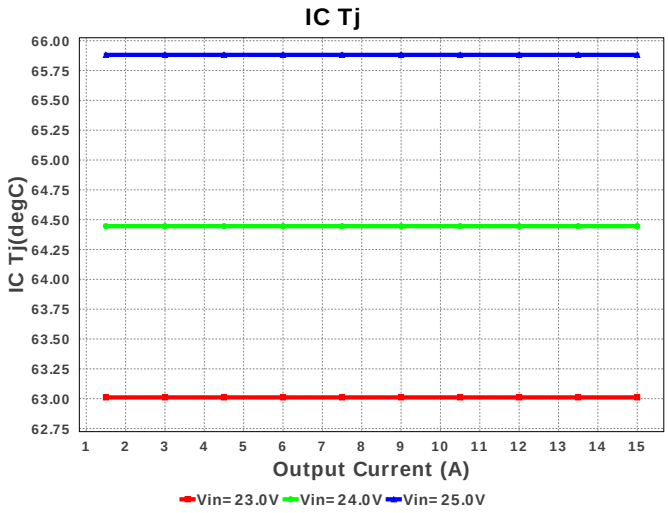


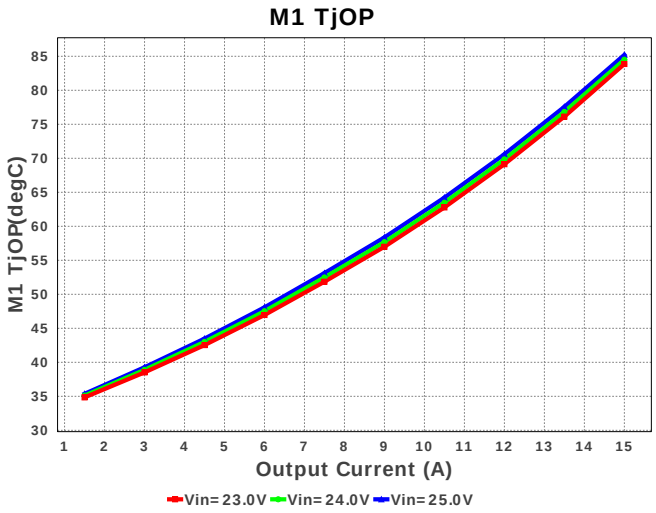


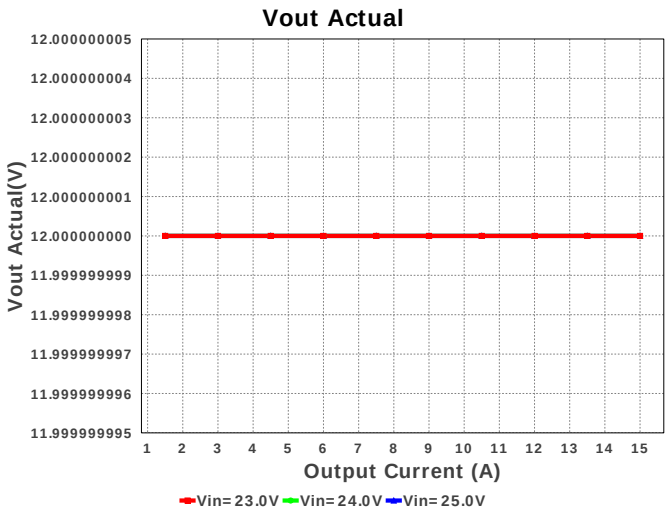


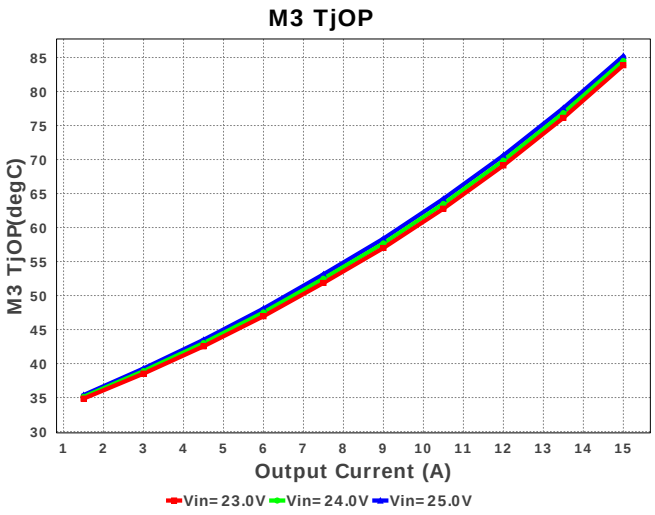


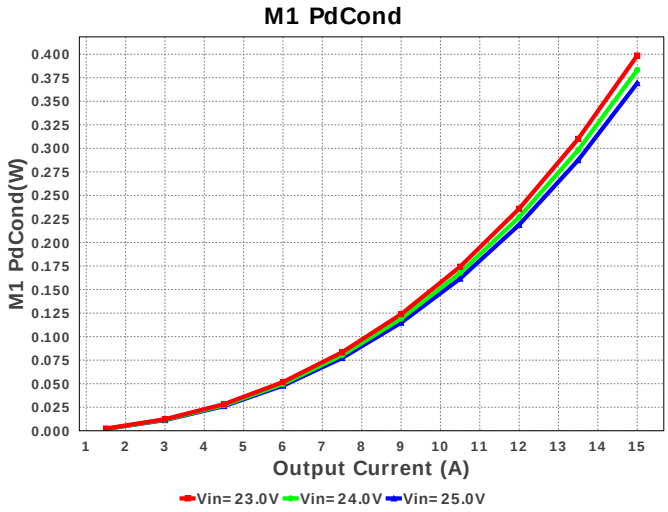


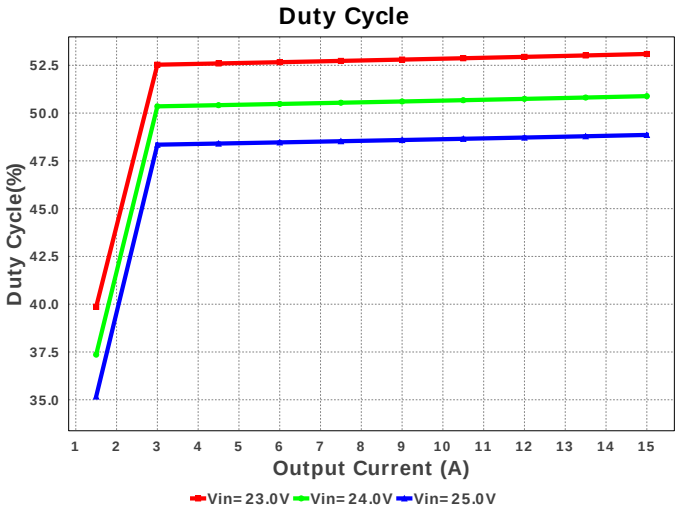


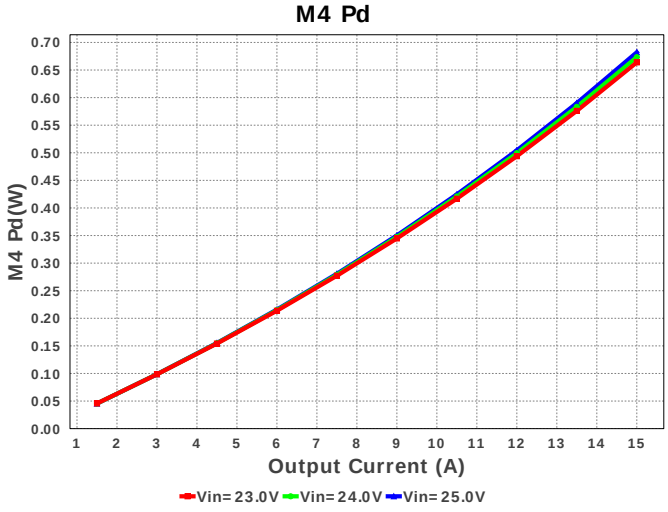


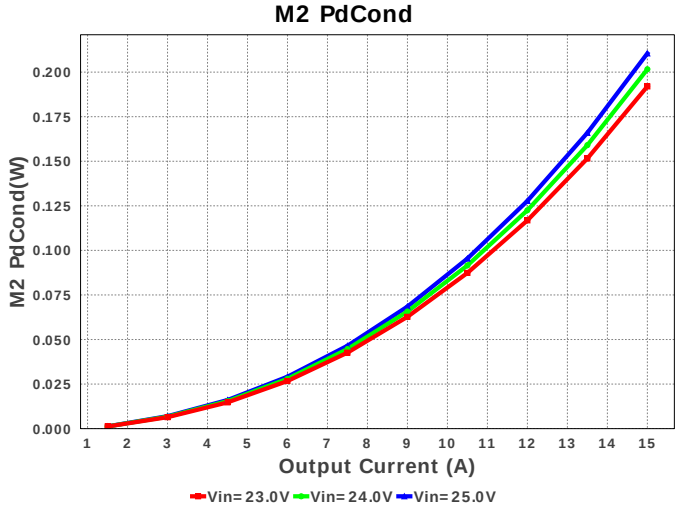


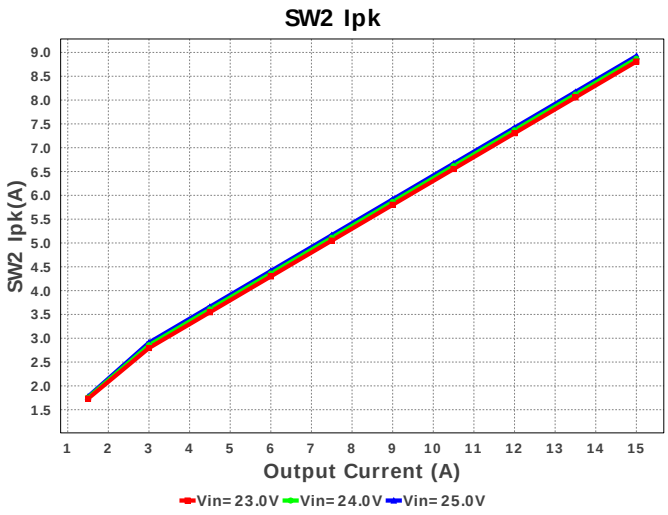


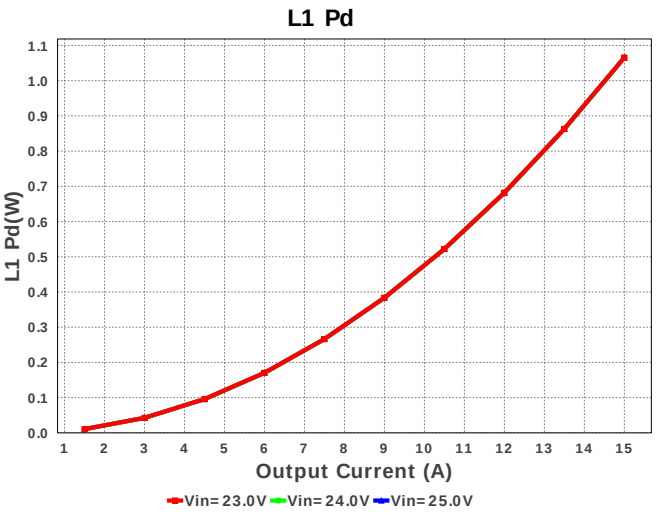


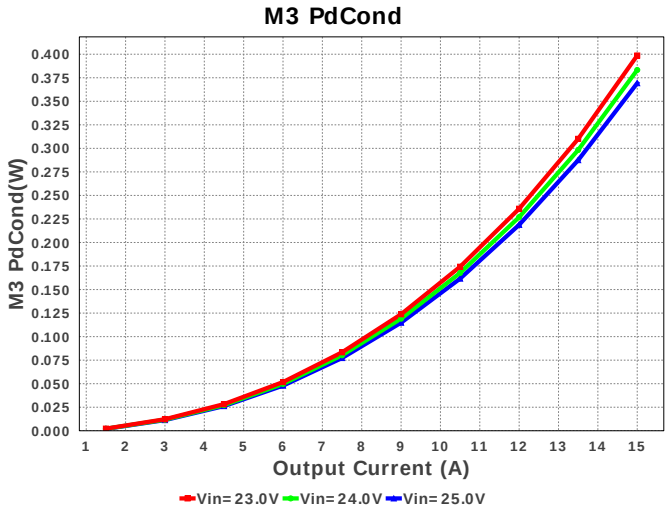


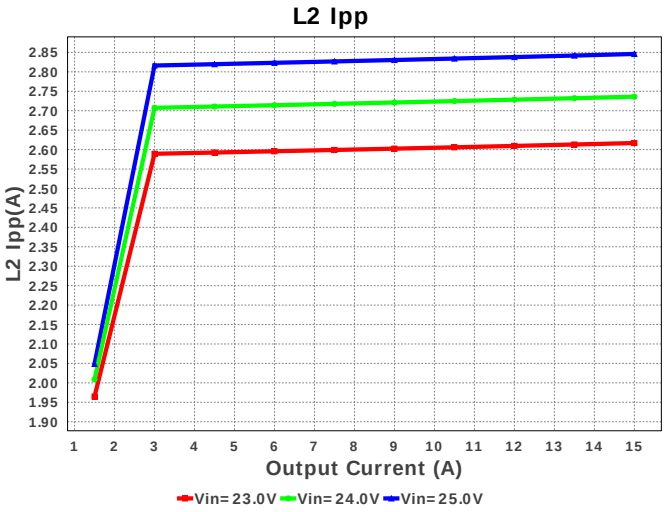


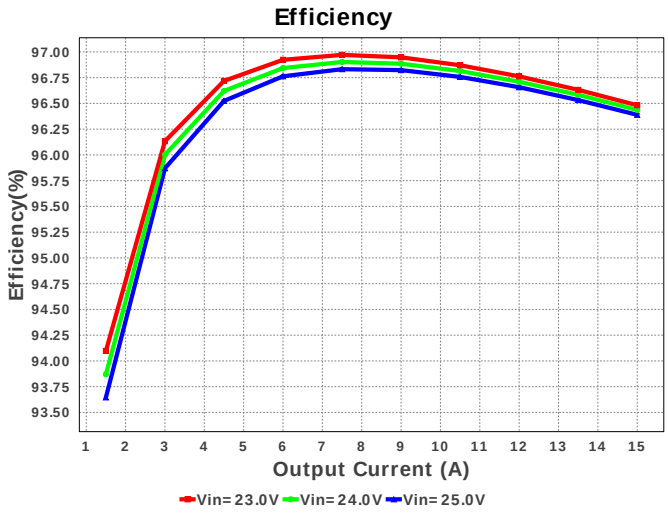


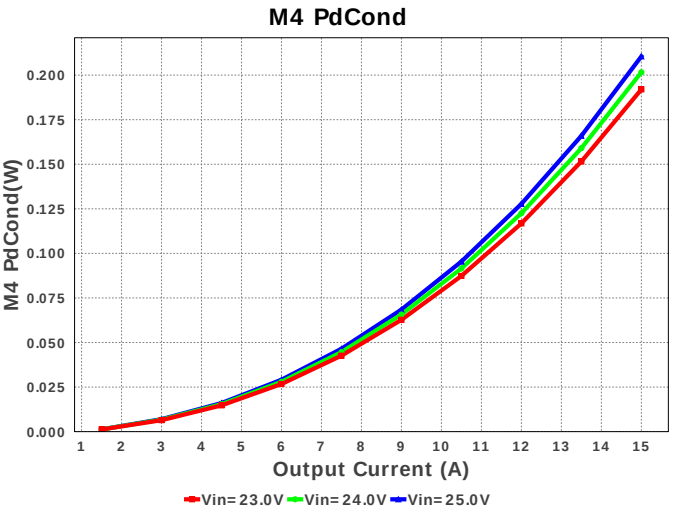


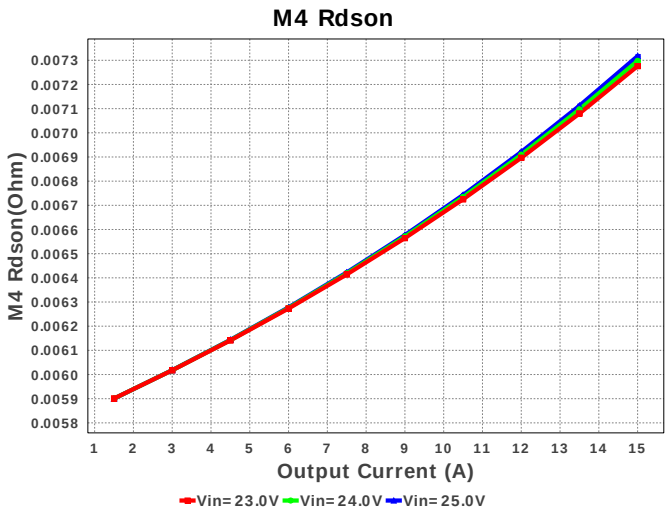


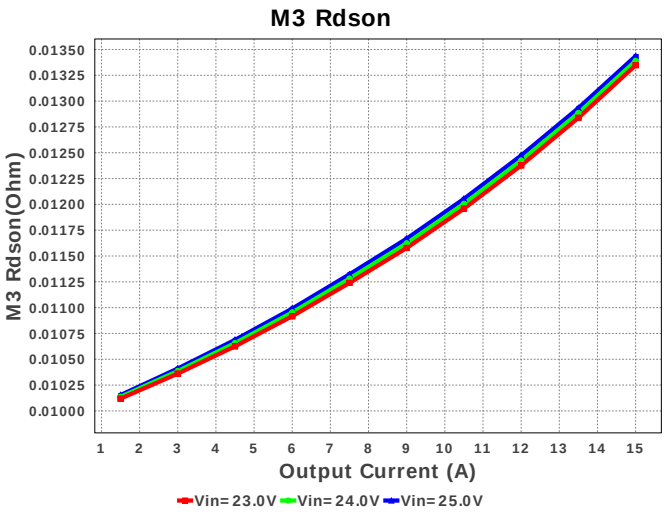


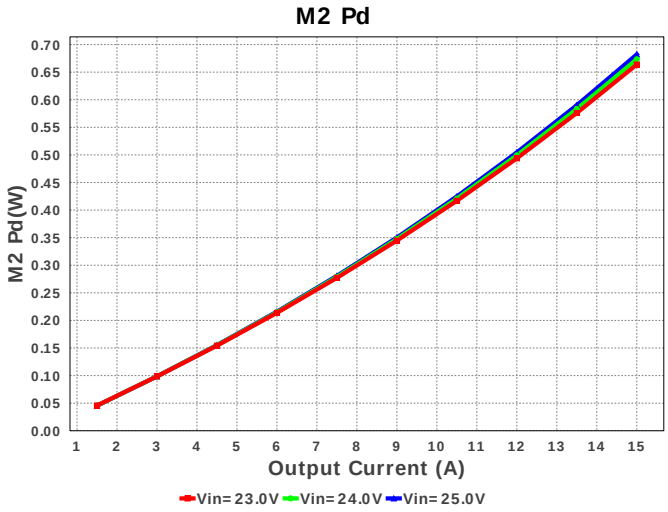


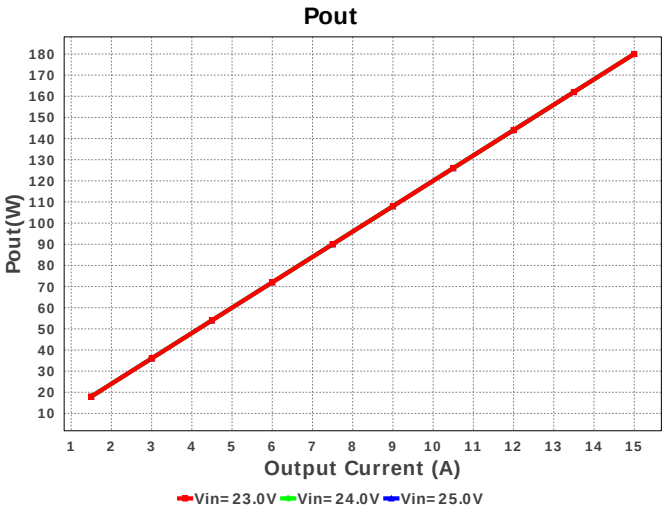


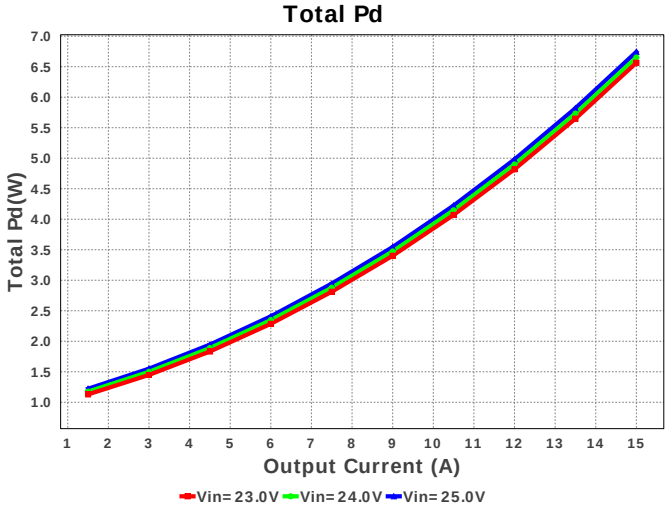


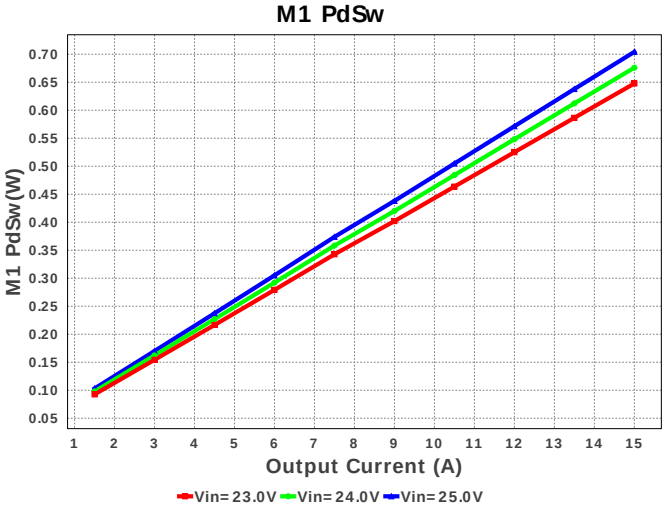


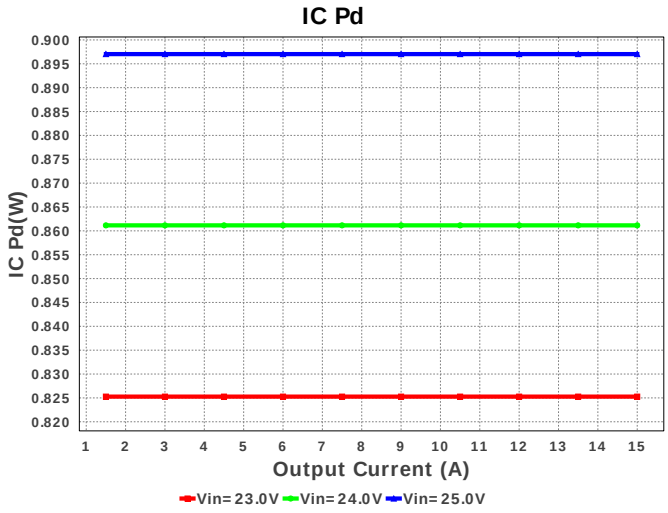


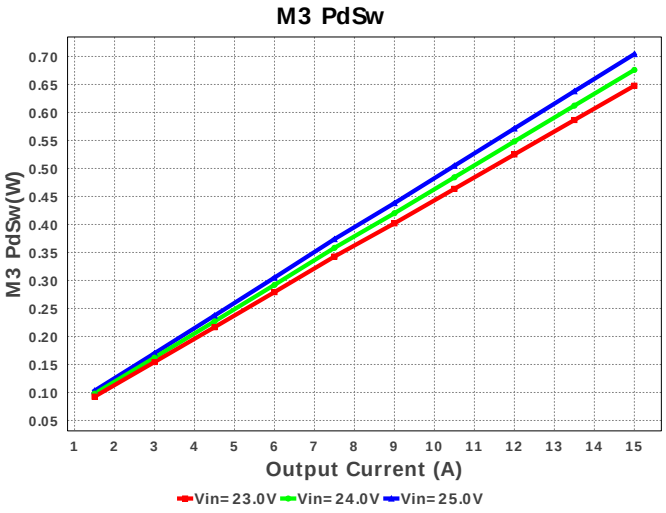


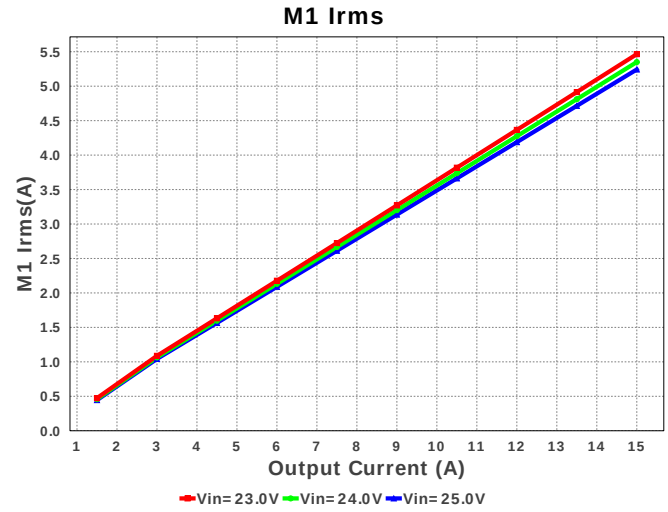


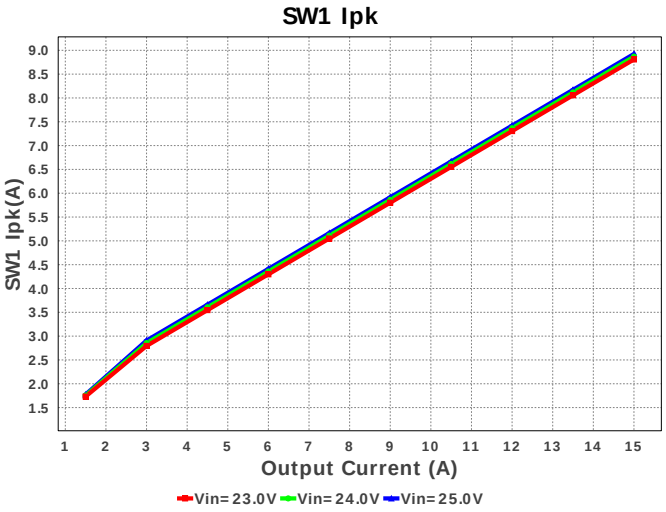


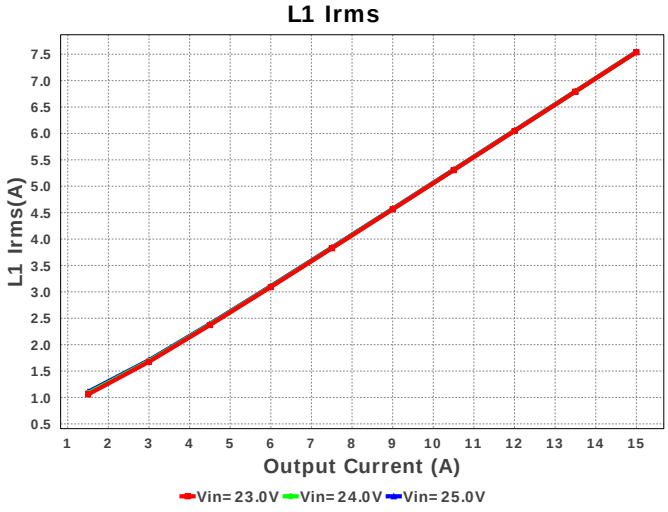


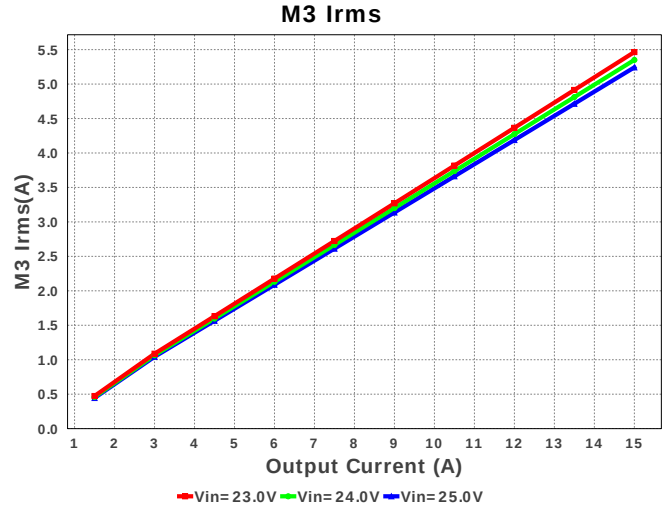


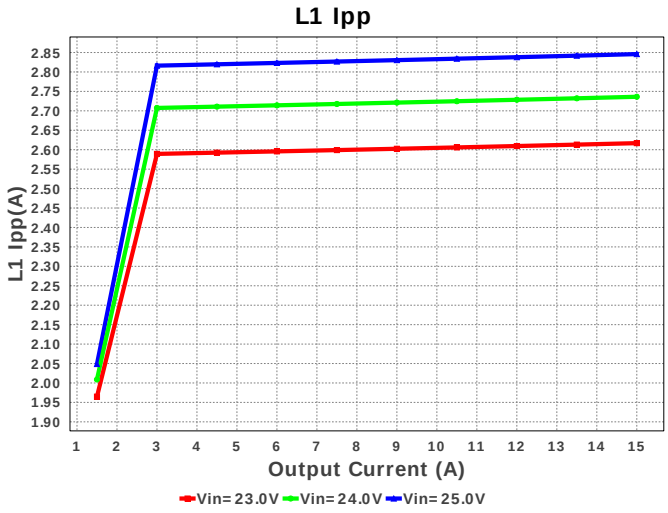


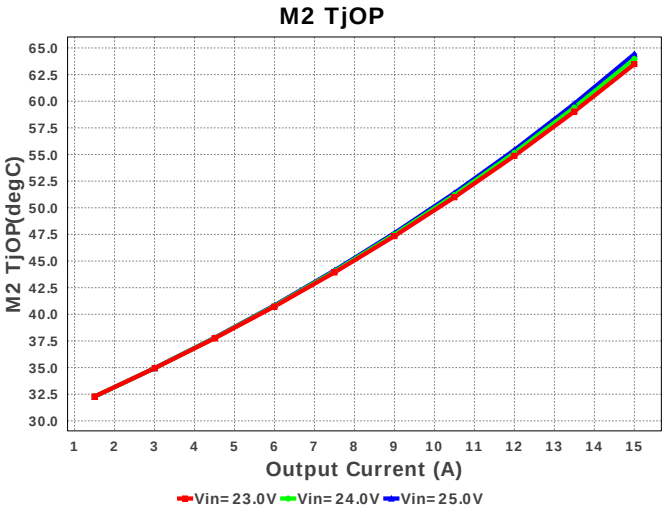


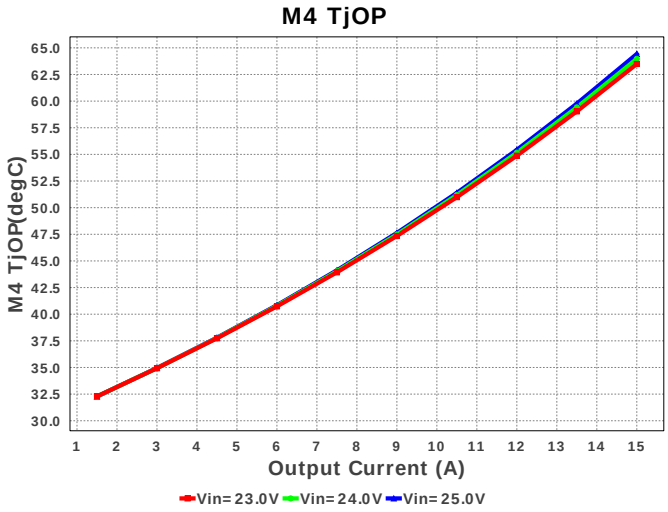


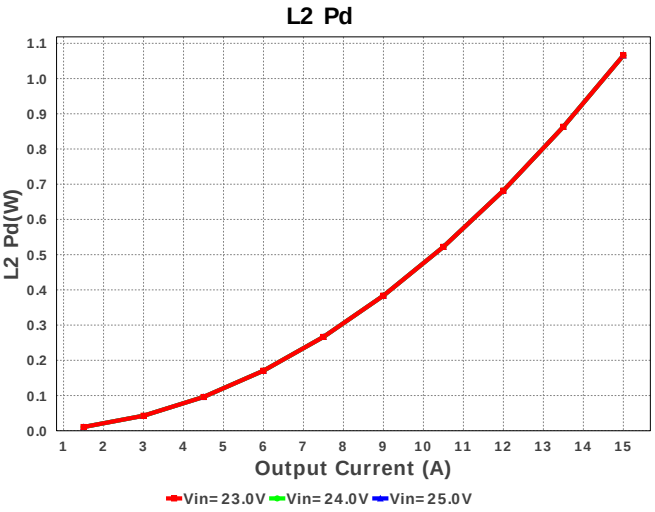


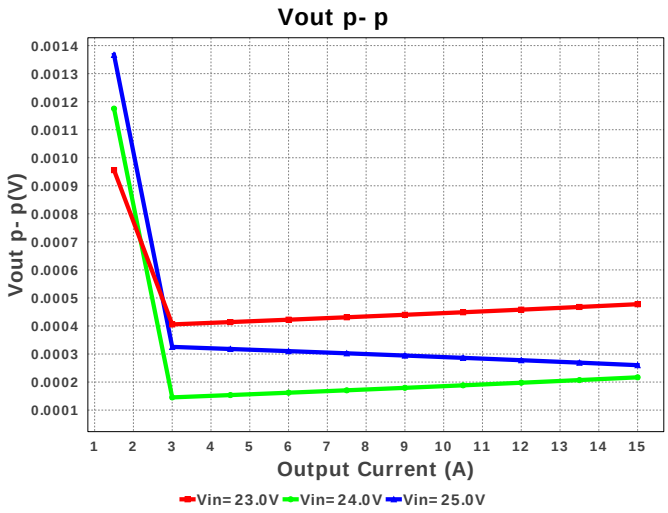


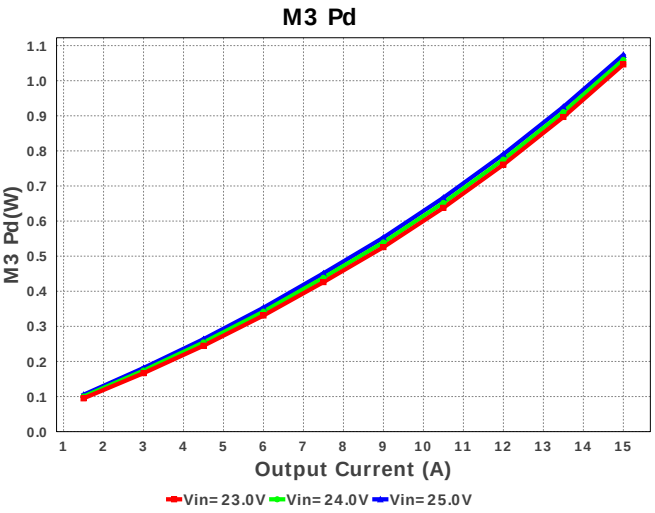


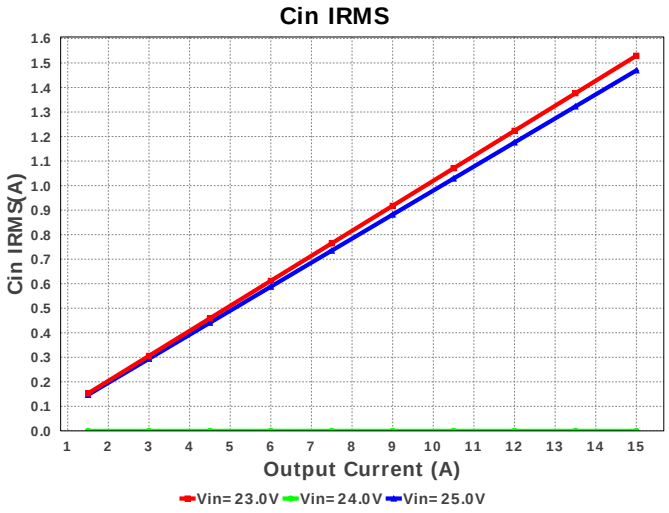












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.47 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	51.226 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	7.478 A	Current	Average input current
4.	L1 Ipp	2.846 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	7.545 A	Current	Inductor ripple current
6.	L2Ipp	2.846 A	Current	Channel 2 Inductor Peak to peak Current
7.	L2 Irms	7.545 A	Current	Inductor ripple current
8.	M1 Irms	5.242 A	Current	MOSFET RMS ripple current
9.	M2 Irms	5.364 A	Current	MOSFET RMS ripple current
10.	M3 Irms	5.242 A	Current	MOSFET RMS ripple current
11.	M4 Irms	5.364 A	Current	MOSFET RMS ripple current
12.	SW1 Ipk	8.923 A	Current	Peak switch current
13.	SW2 Ipk	8.923 A	Current	Peak switch current
14.	BOM Count	38	General	Total Design BOM count
15.	FootPrint	730.0 mm^2	General	Total Foot Print Area of BOM components
16.	Frequency	398.529 kHz	General	Switching frequency
17.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
18.	Pout	180.0 W	General	Total output power
19.	Total BOM	$10.08	General	Total BOM Cost
20.	M3 TjOP	85.579 degC	Op_Point	M3 MOSFET junction temperature
21.	M4 TjOP	64.423 degC	Op_Point	M4 MOSFET junction temperature
22.	Vout Actual	12.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
23.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
24.	Duty Cycle	48.857 %	Op_point	Duty cycle
25.	Efficiency	96.278 %	Op_point	Steady state efficiency
26.	IC Tj	65.881 degC	Op_point	IC junction temperature
27.	IOUT_OP	15.0 A	Op_point	Iout operating point
28.	M1 TjOP	85.579 degC	Op_point	M1 MOSFET junction temperature
29.	M2 TjOP	64.423 degC	Op_point	M2 MOSFET junction temperature
30.	VIN_OP	25.0 V	Op_point	Vin operating point
31.	Vout p-p	260.217 µV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	2.169 mW	Power	Input capacitor power dissipation
33.	Cout Pd	796.94 nW	Power	Output capacitor power dissipation
34.	IC Pd	897.031 mW	Power	IC power dissipation
35.	L1 Pd	1.066 W	Power	Inductor power dissipation
36.	L2 Pd	1.066 W	Power	Inductor power dissipation
37.	M1 Pd	1.081 W	Power	M1 MOSFET total power dissipation
38.	M1 PdCond	369.917 mW	Power	M1 MOSFET conduction losses
39.	M1 PdSw	710.816 mW	Power	M1 MOSFET switching losses
40.	M2 Pd	682.124 mW	Power	M2 MOSFET total power dissipation
41.	M2 PdCond	210.504 mW	Power	M2 MOSFET conduction losses
42.	M2 PdSw	471.619 mW	Power	M2 MOSFET switching losses
43.	M3 Pd	1.081 W	Power	M3 MOSFET total power dissipation
44.	M3 PdCond	369.917 mW	Power	M3 MOSFET conduction losses
45.	M3 PdSw	710.816 mW	Power	M3 MOSFET switching losses
46.	M1 Rdson	13.46 mOhm	Power	Drain-Source On-resistance
47.	M3 Rdson	13.46 mOhm	Power	Drain-Source On-resistance
48.	M4 Pd	682.124 mW	Power	M4 MOSFET total power dissipation
49.	M4 PdCond	210.504 mW	Power	M4 MOSFET conduction losses
50.	M4 PdSw	471.619 mW	Power	M4 MOSFET switching losses
51.	M2 Rdson	7.317 mOhm	Power	Drain-Source On-resistance
52.	M4 Rdson	7.317 mOhm	Power	Drain-Source On-resistance

#	Name	Value	Category	Description
53.	Rsense1 Pd	201.374 mW	Power	Current Limit Sense Resistor Power Dissipation
54.	Rsense2 Pd	201.374 mW	Power	Current Limit Sense Resistor Power Dissipation
55.	Total Pd	6.959 W	Power	Total Power Dissipation
56.	Cross Freq Ch1	35.295 kHz	Unknown	Bode plot crossover frequency
57.	Phase Marg Ch1	52.243 deg	Unknown	Bode Plot Phase Margin
58.	Vout Tolerance	2.293 %	Unknown	Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	15.0	Maximum Output Current
2.	VinMax	25.0	Maximum input voltage
3.	VinMin	23.0	Minimum input voltage
4.	Vout	12.0	Output Voltage
5.	base_pn	LM25119	Base Product 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. **LM25119** Product Folder : http://www.ti.com/product/LM25119 : contains the data sheet and other resources.