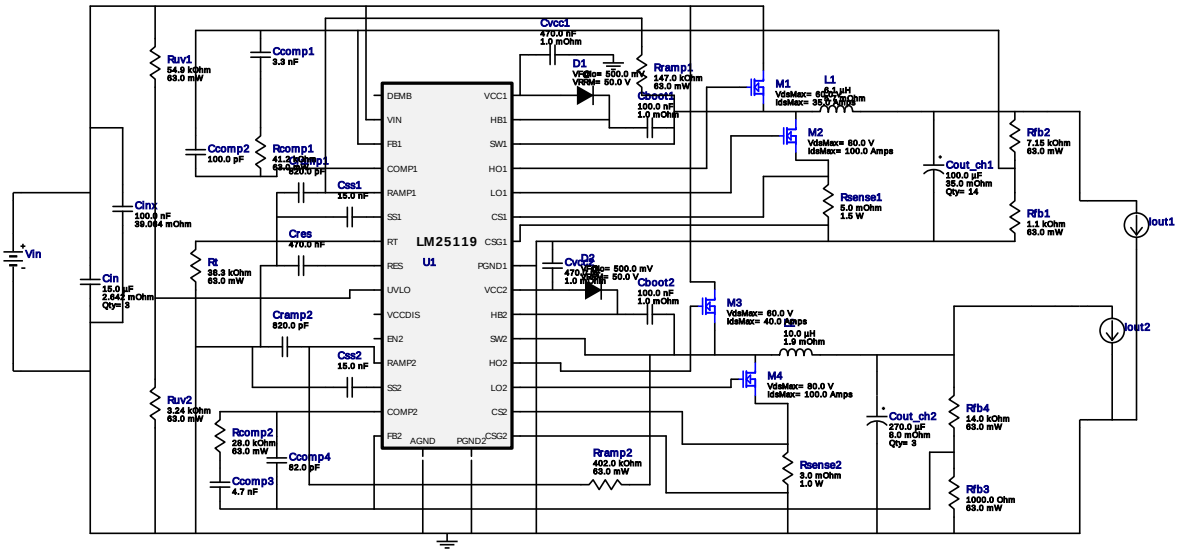
WEBENCH® Design Report

VinMin = 28.0V
VinMax = 35.0V
Vout = 6.0V
Iout = 15.0A

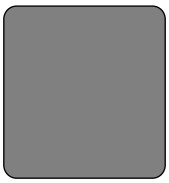
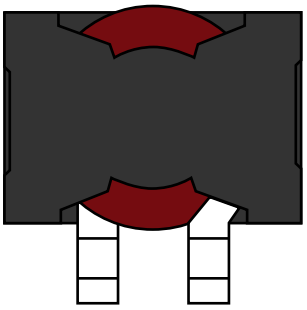
Device = LM25119PSQ/NOPB
Topology = Buck
Created = 2017-12-11 15:33:01.749
BOM Cost = $0.00
BOM Count = 56
Total Pd = 11.54W

Design : 5194892/1 LM25119PSQ/NOPB
LM25119PSQ/NOPB 28.0V-35.0V to 12.00V @ 15.0A

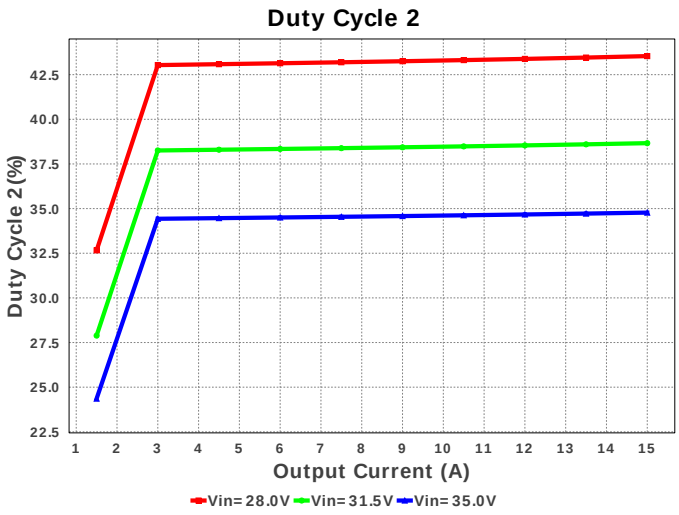


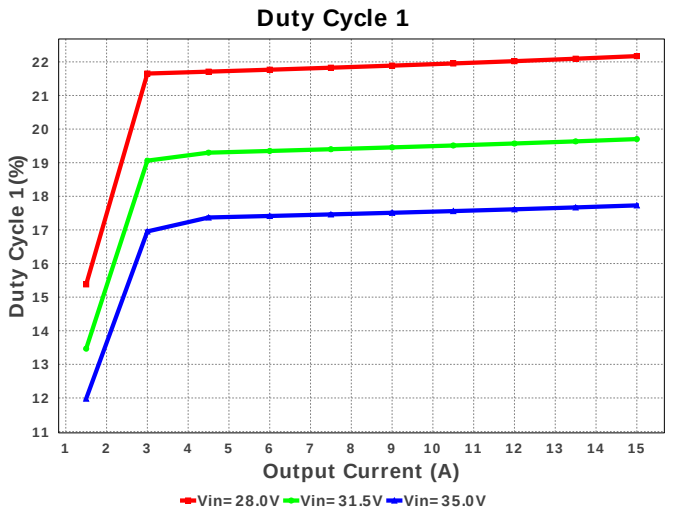
Electrical BOM

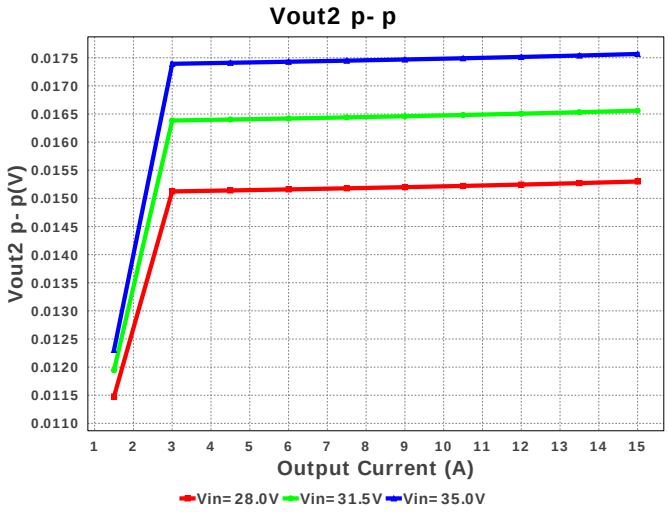
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot1	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cboot2	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
3.	Ccomp1	AVX	04025A331JAT2A Series= C0G/NP0	Cap= 3.3 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.05	0402 3 mm²
4.	Ccomp2	Samsung Electro-Mechanics	CL02C101JQ2ANNC Series= C0G/NP0	Cap= 100.0 pF VDC= 6.3 V IRMS= 0.0 A	1	$0.03	01005 2 mm²
5.	Ccomp3	AVX	04025A471JAT2A Series= C0G/NP0	Cap= 4.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
6.	Ccomp4	TDK	C0402C0G1C820J020BC Series= C0G/NP0	Cap= 82.0 pF VDC= 16.0 V IRMS= 0.0 A	1	$0.04	01005 2 mm²
7.	Cin	TDK	C5750X7S2A156M250KB Series= X7S	Cap= 15.0 uF ESR= 2.642 mOhm VDC= 100.0 V IRMS= 5.6162 A	3	$1.23	2220_280 54 mm²
8.	Cinx	TDK	C1005X5R1H104K050BB Series= X5R	Cap= 100.0 nF ESR= 39.064 mOhm VDC= 50.0 V IRMS= 814.67 mA	1	$0.02	0402 3 mm²
9.	Cout_ch1	Panasonic	8TPE100MAZB Series= TPE	Cap= 100.0 uF ESR= 35.0 mOhm VDC= 8.0 V IRMS= 1.4 A	14	$0.51	3528-21 17 mm²

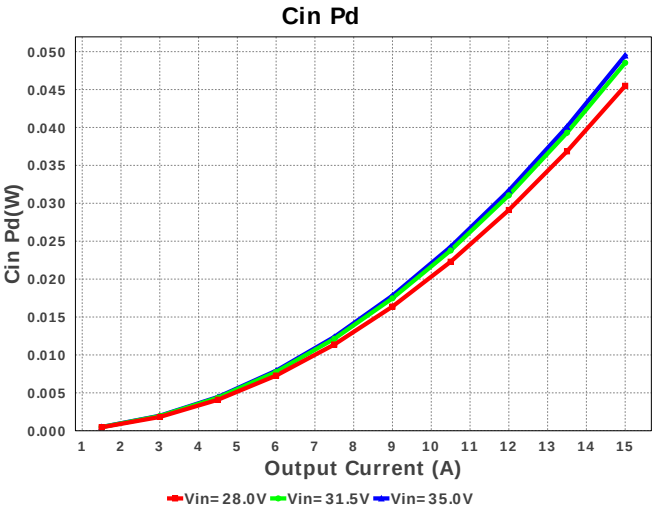
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cout_ch2	Panasonic	16SVPG270M Series= SVPG	Cap= 270.0 uF ESR= 8.0 mOhm VDC= 16.0 V IRMS= 5.8 A	3	$0.68	 CAPSMT_62_C10 74 mm²
11.	Cramp1	AVX	0201ZA820JAT2A Series= C0G/NP0	Cap= 820.0 pF VDC= 10.0 V IRMS= 0.0 A	1	$0.05	 0201 2 mm²
12.	Cramp2	AVX	0201ZA820JAT2A Series= C0G/NP0	Cap= 820.0 pF VDC= 10.0 V IRMS= 0.0 A	1	$0.05	 0201 2 mm²
13.	Cres	Panasonic	ECPU1C474MA5 Series= ECPU(A)	Cap= 470.0 nF VDC= 16.0 V IRMS= 0.0 A	1	NA	 1206 11 mm²
14.	Css1	TDK	C2012C0G1H153J085AA Series= C0G/NP0	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.07	 0805 7 mm²
15.	Css2	TDK	C2012C0G1H153J085AA Series= C0G/NP0	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.07	 0805 7 mm²
16.	Cvcc1	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
17.	Cvcc2	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
18.	D1	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 50.0 V	1	NA	CUSTOM 0 mm²
19.	D2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 50.0 V	1	NA	CUSTOM 0 mm²
20.	L1	Coilcraft	XAL1580-612MEB	L= 6.1 µH DCR= 5.7 mOhm	1	$2.40	 XAL1580 313 mm²
21.	L2	Coilcraft	SER2915H-103KL	L= 10.0 µH DCR= 1.9 mOhm	1	$1.95	 SER2915H 652 mm²
22.	M1	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	$0.27	 DNH0008A 18 mm²
23.	M2	Infineon Technologies	BSC037N08NS5ATMA1	VdsMax= 80.0 V IdsMax= 100.0 Amps	1	$1.11	 PG-TDSON-8 55 mm²
24.	M3	Infineon Technologies	BSZ100N06LS3 G	VdsMax= 60.0 V IdsMax= 40.0 Amps	1	$0.37	 PG-TSDSON-8 19 mm²

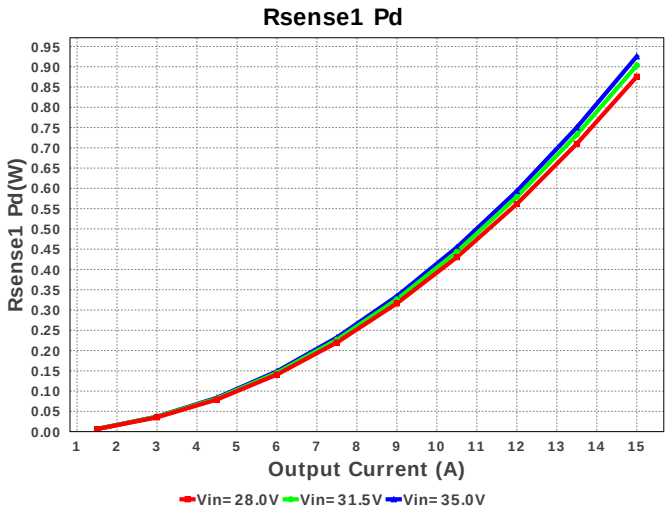
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
25.	M4	Infineon Technologies	BSC037N08NS5ATMA1	VdsMax= 80.0 V IdsMax= 100.0 Amps	1	$1.11	 PG-TDSON-8 55 mm²
26.	Rcomp1	Vishay-Dale	CRCW040241K2FKED Series= CRCW..e3	Res= 41.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
27.	Rcomp2	Vishay-Dale	CRCW040228K0FKED Series= CRCW..e3	Res= 28.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
28.	Rfb1	Vishay-Dale	CRCW04021K10FKED Series= CRCW..e3	Res= 1.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
29.	Rfb2	Vishay-Dale	CRCW04027K15FKED Series= CRCW..e3	Res= 7.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
30.	Rfb3	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
31.	Rfb4	Vishay-Dale	CRCW040214K0FKED Series= CRCW..e3	Res= 14.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
32.	Rramp1	Vishay-Dale	CRCW0402147KFKED Series= CRCW..e3	Res= 147.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
33.	Rramp2	Vishay-Dale	CRCW0402402KFKED Series= CRCW..e3	Res= 402.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
34.	Rsense1	Stackpole Electronics Inc	CSNL2010FT5L00 Series= ?	Res= 5.0 mOhm Power= 1.5 W Tolerance= 1.0%	1	$0.19	 2010 32 mm²
35.	Rsense2	Stackpole Electronics Inc	CSNL1206FT3L00 Series= CSNL	Res= 3.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	 1206 11 mm²
36.	Rt	Vishay-Dale	CRCW040238K3FKED Series= CRCW..e3	Res= 38.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
37.	Ruv1	Vishay-Dale	CRCW040254K9FKED Series= CRCW..e3	Res= 54.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
38.	Ruv2	Vishay-Dale	CRCW04023K24FKED Series= CRCW..e3	Res= 3.24 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
39.	U1	Texas Instruments	LM25119PSQ/NOPB	Switcher	1	$2.60	 SQA32A 49 mm²

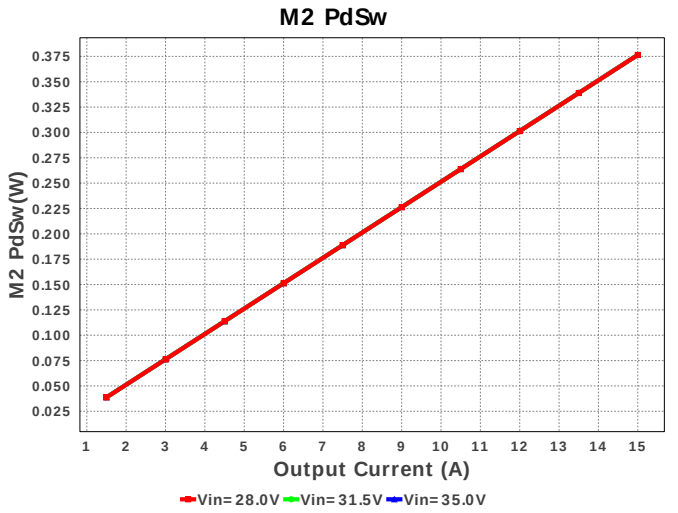


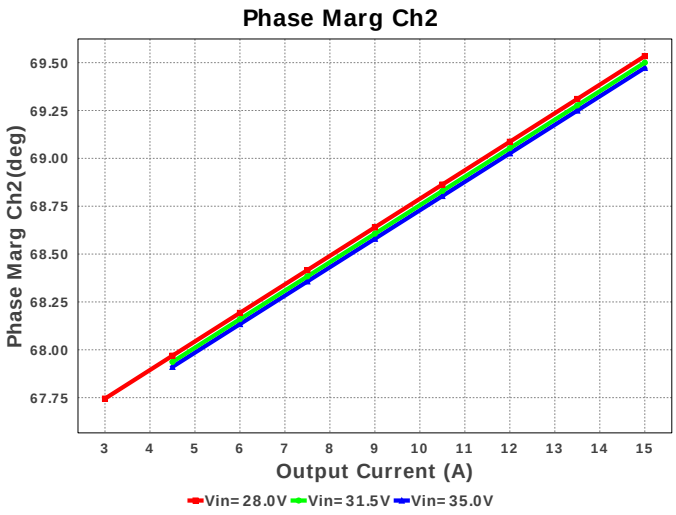


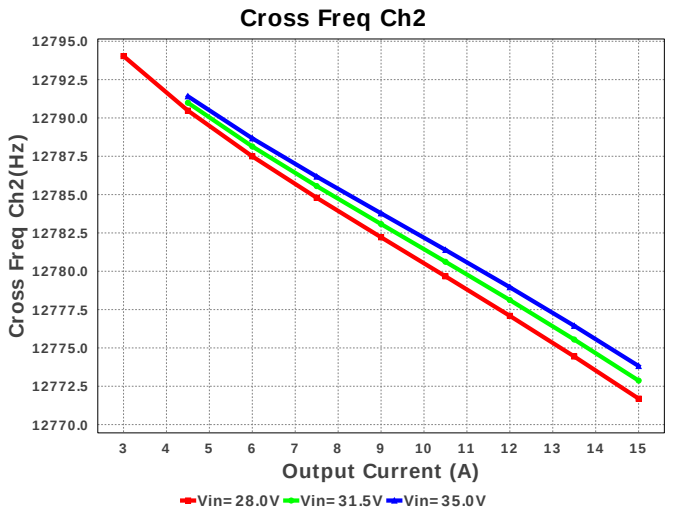


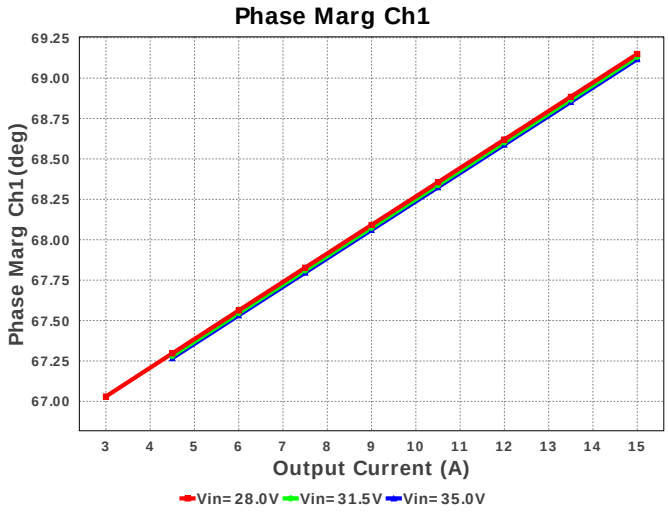


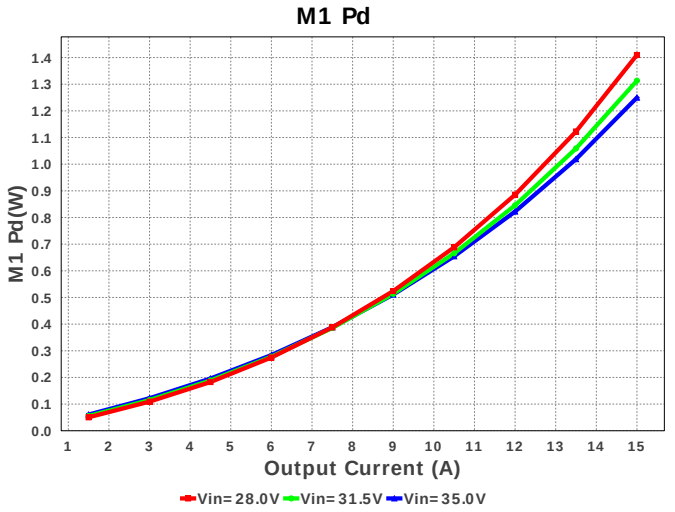


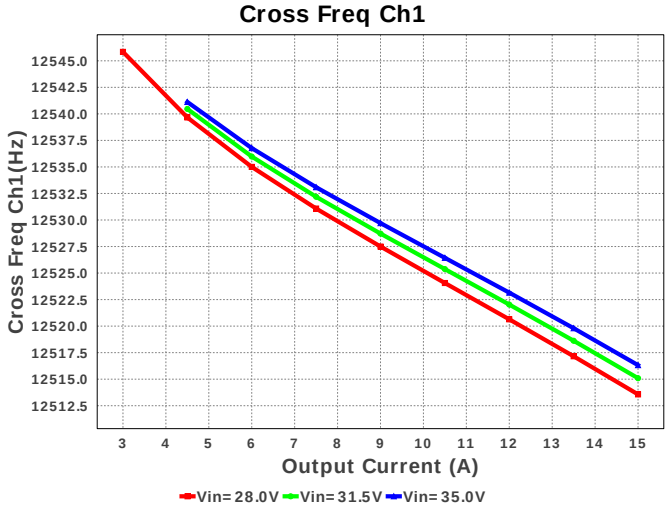


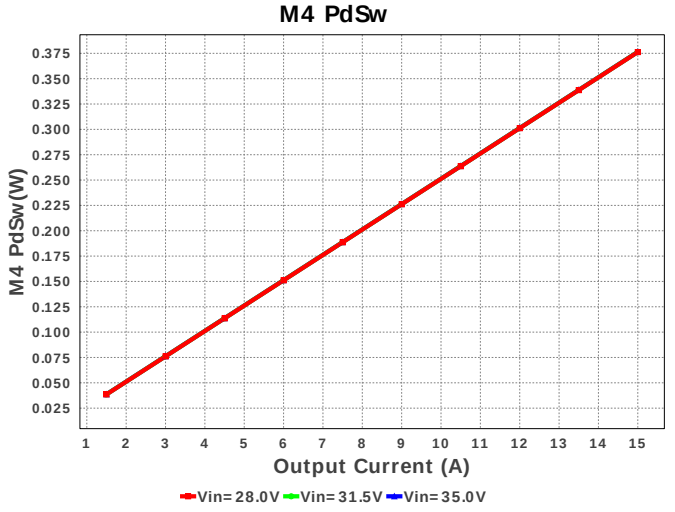


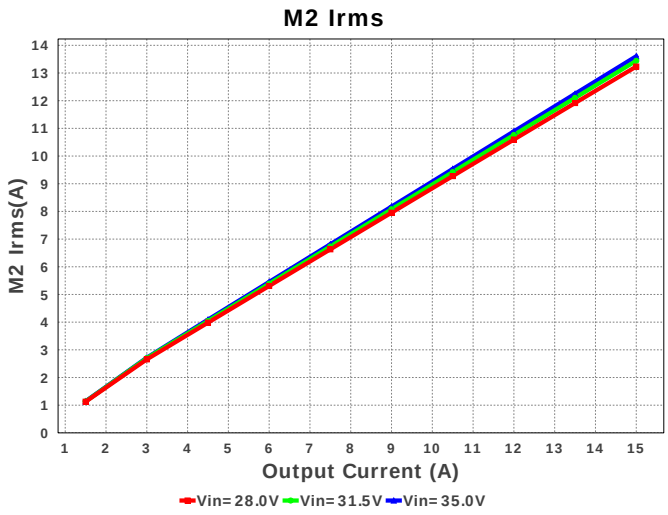


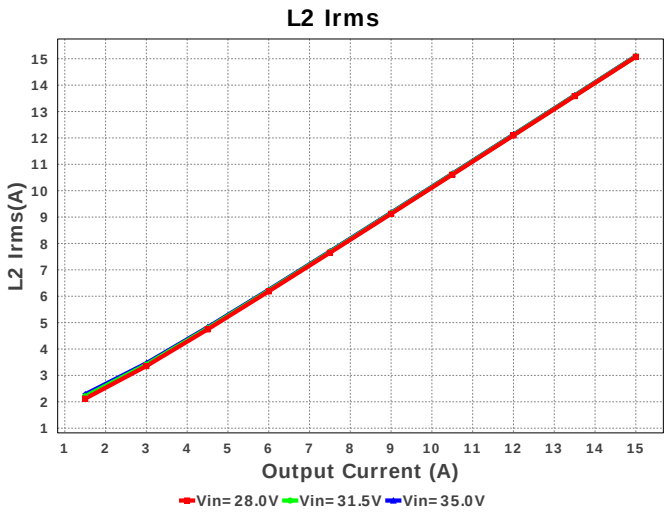


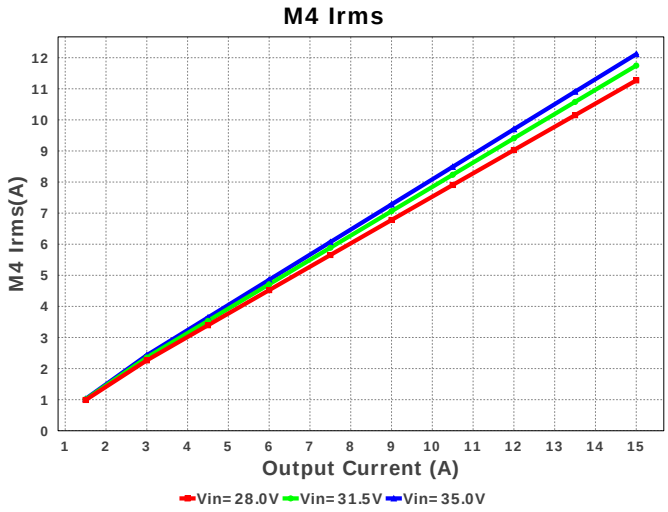


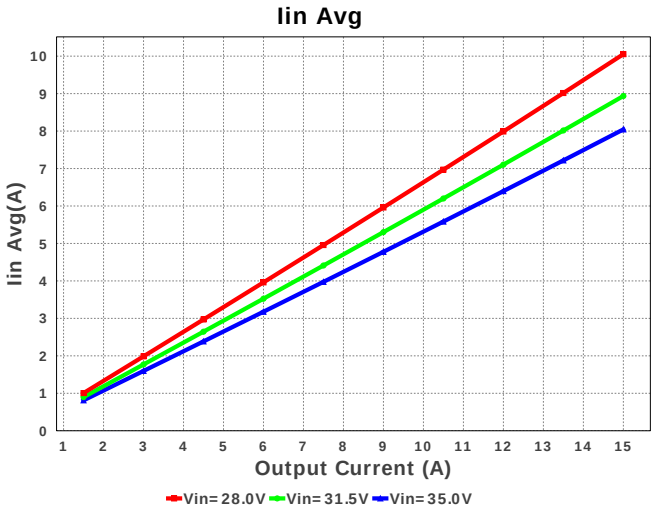


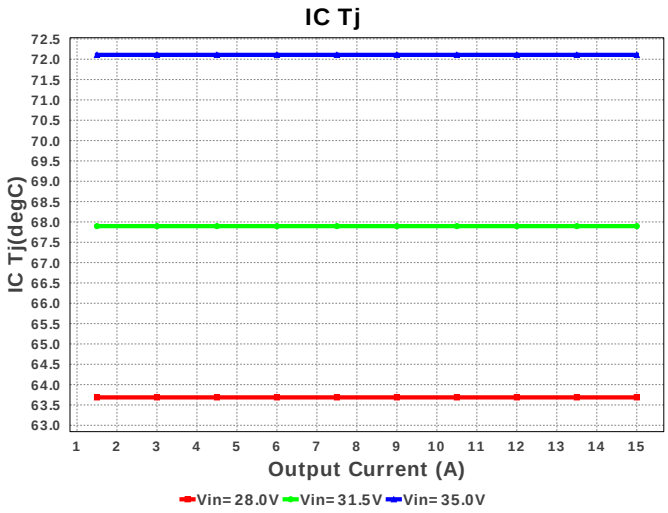


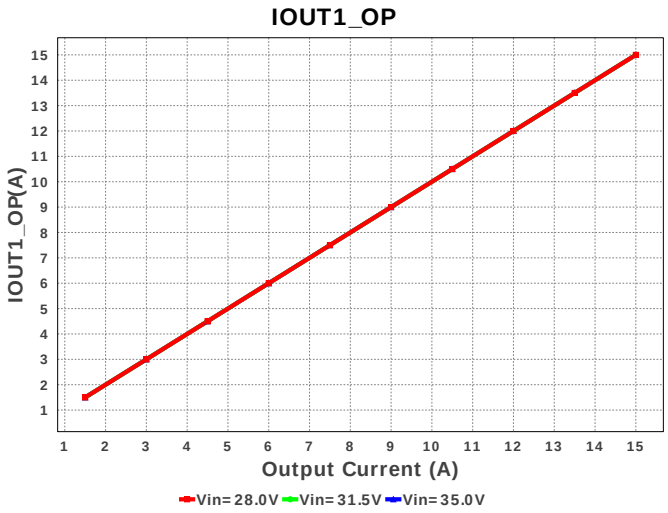


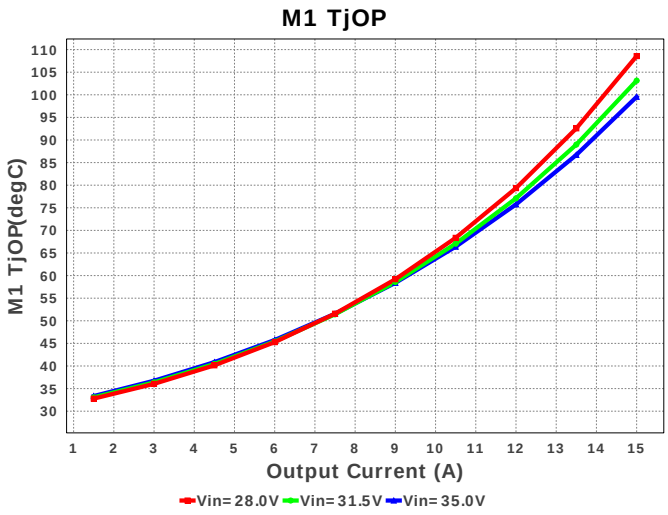


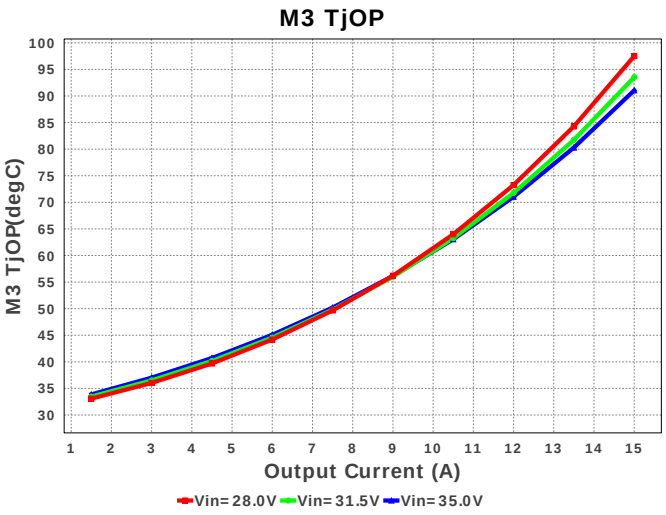


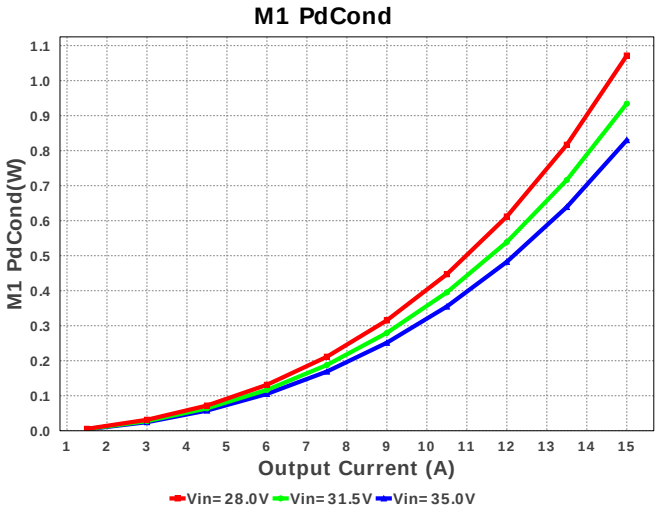


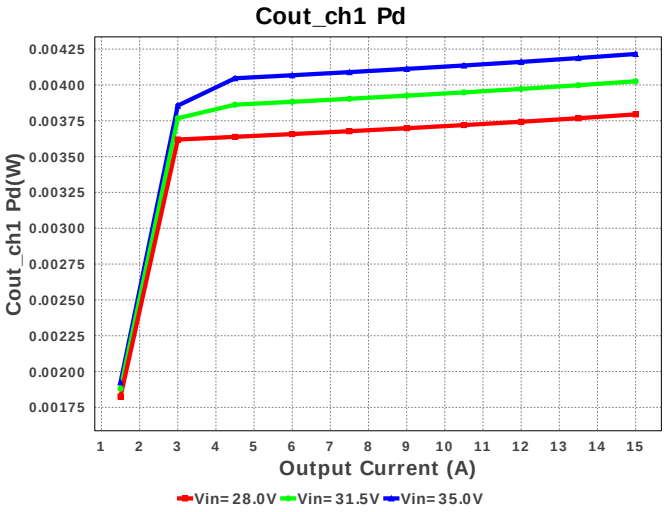


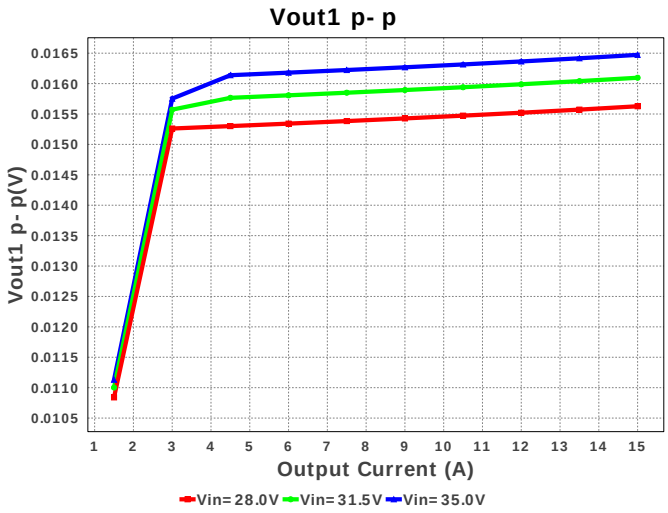


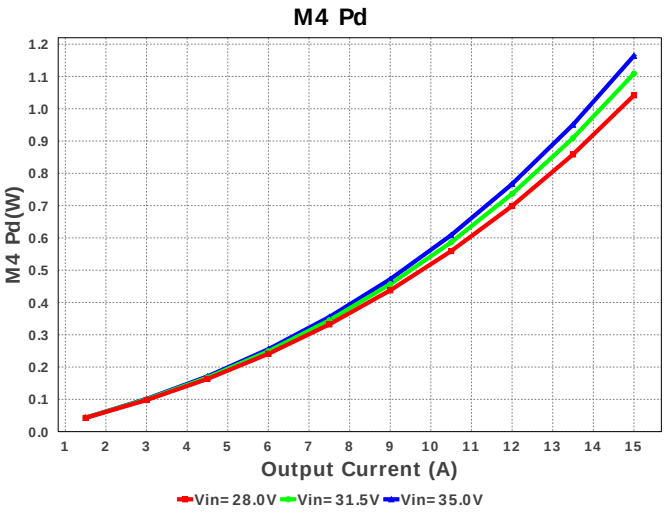


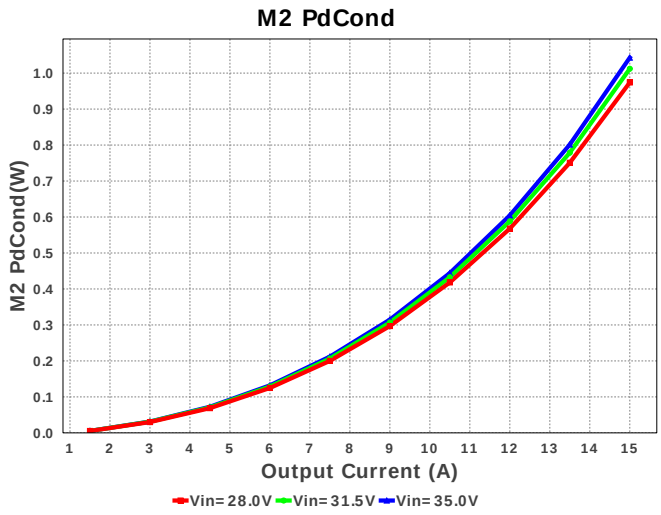


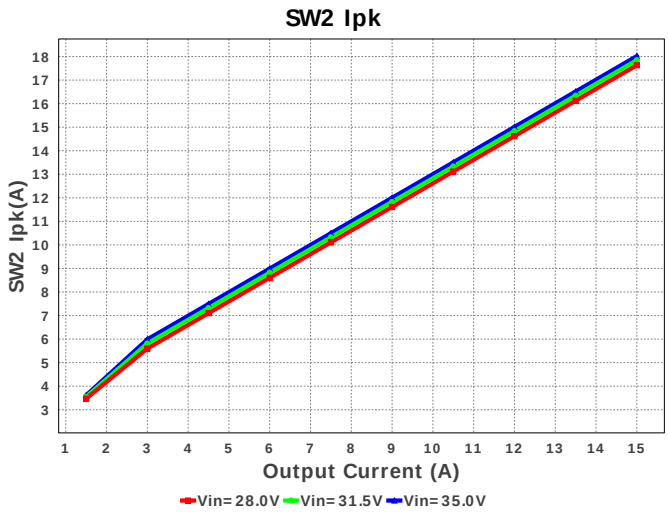


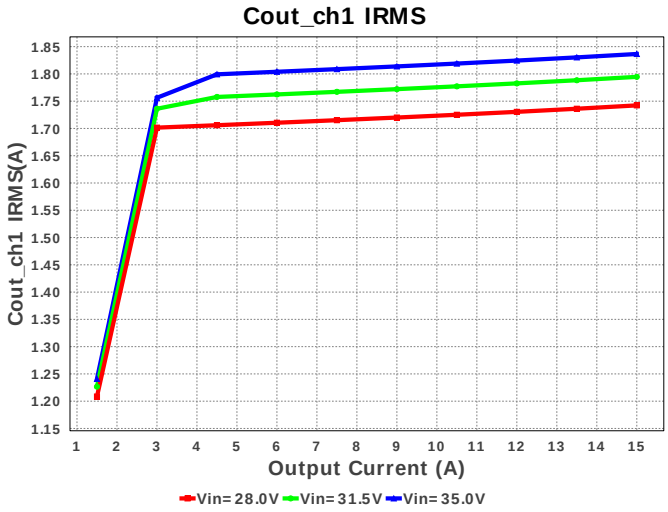


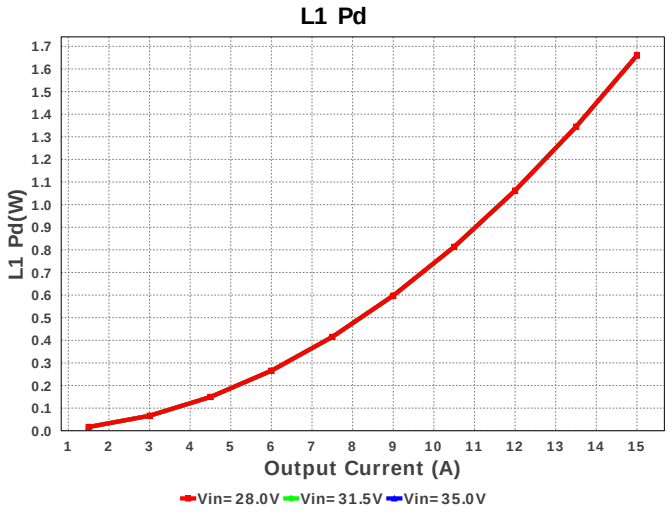


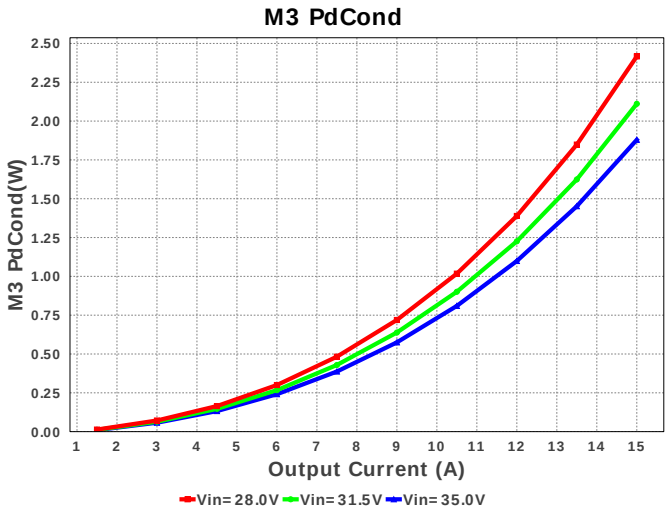


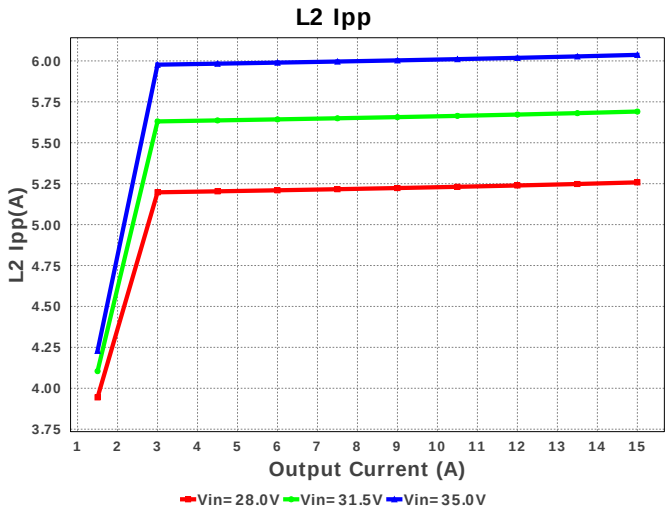




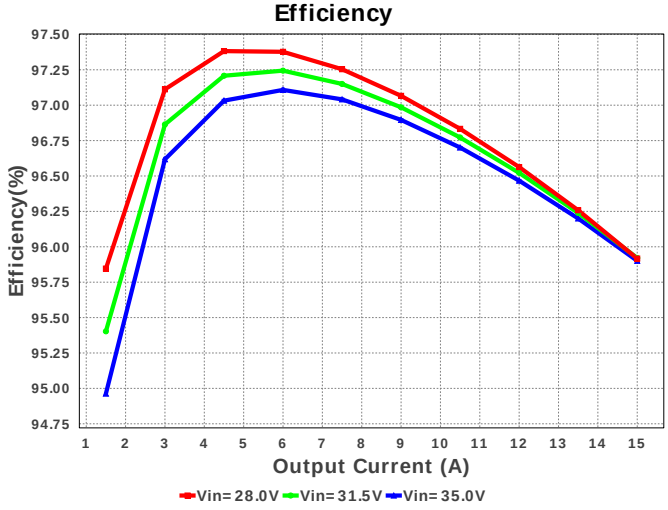




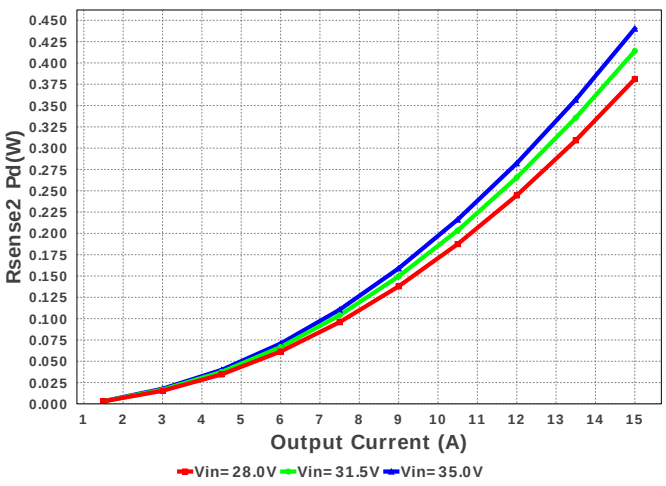




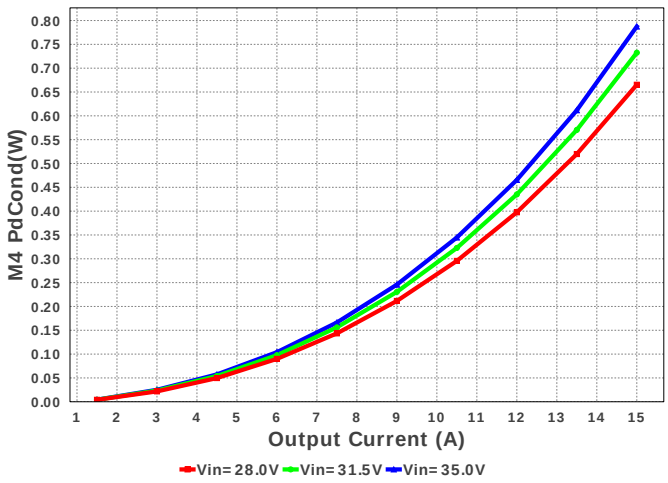
Efficiency



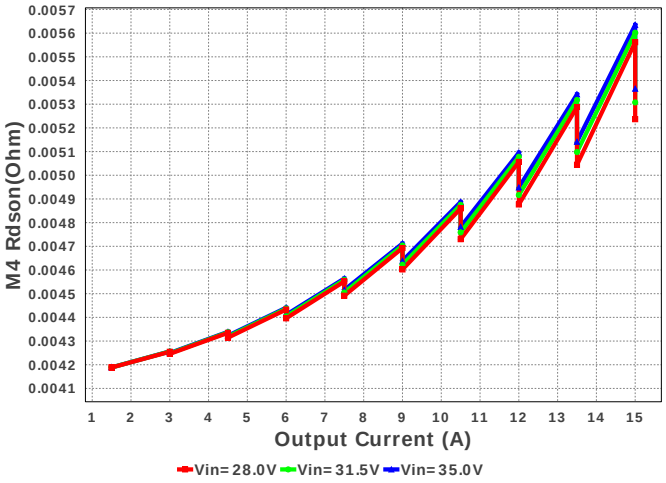
Rsense2 Pd



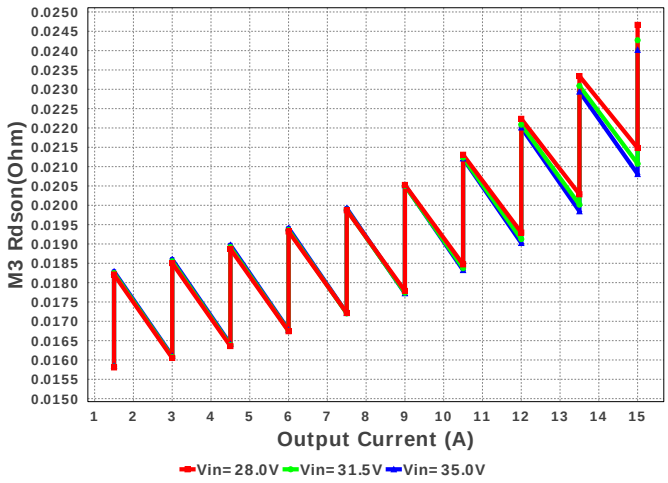
M4 PdCond



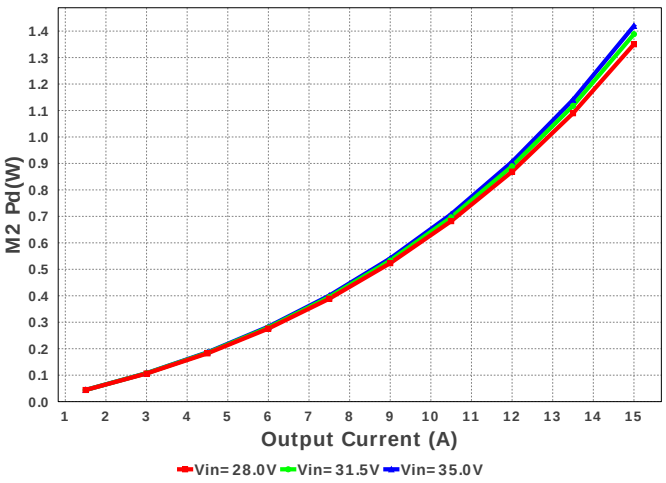
M4 Rdson

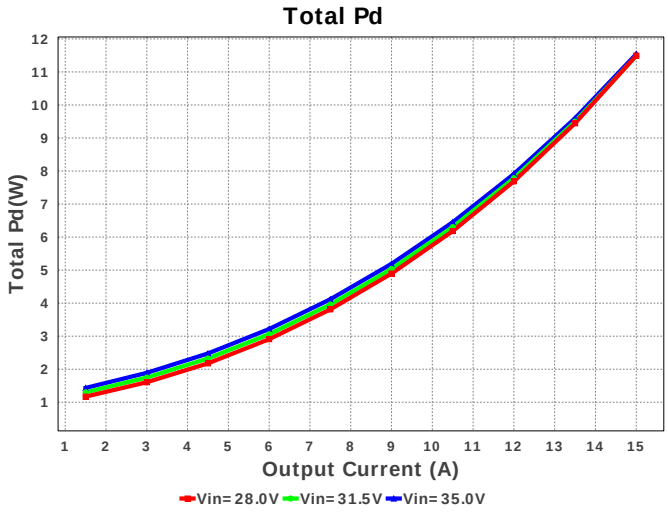


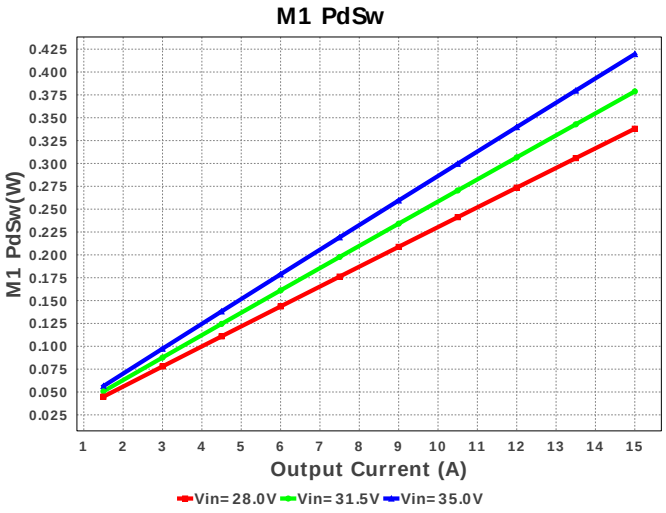
M3 Rdson

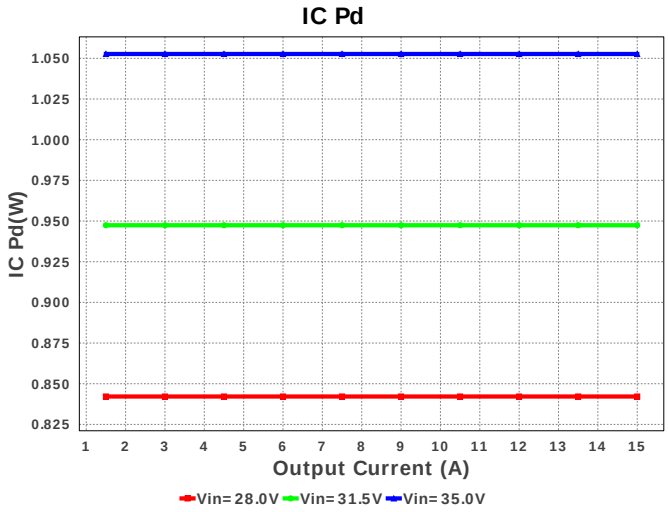


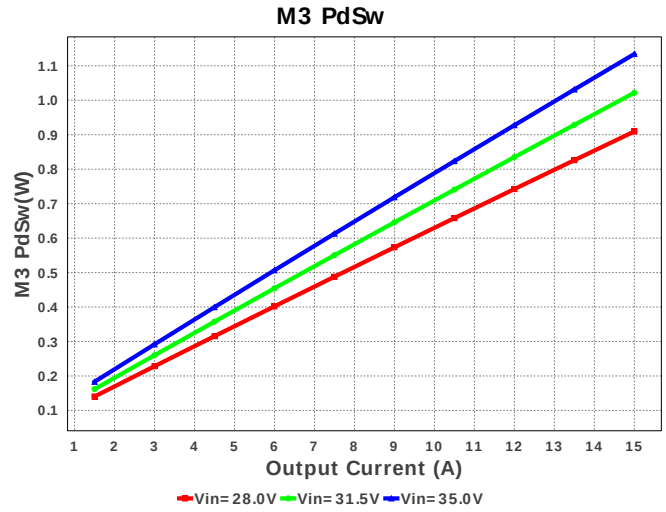
M2 Pd

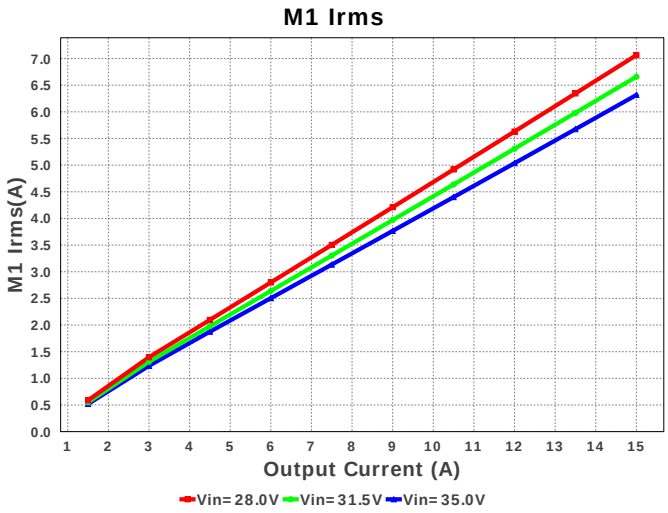


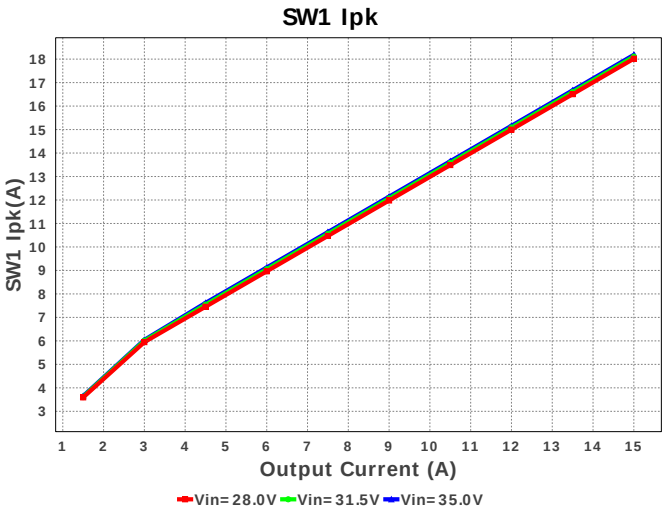


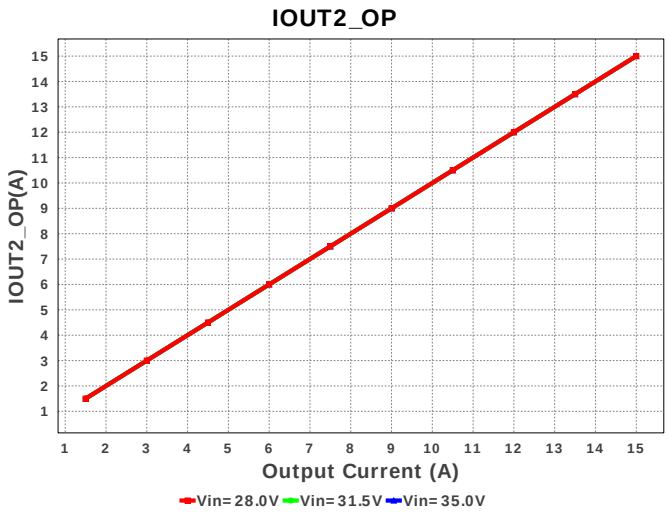


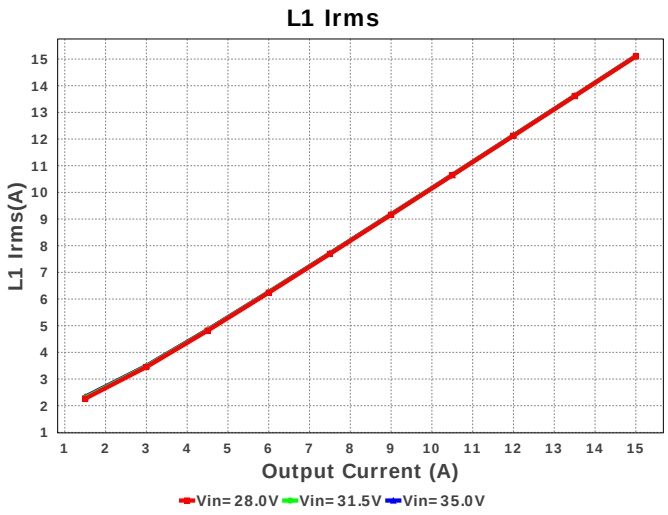


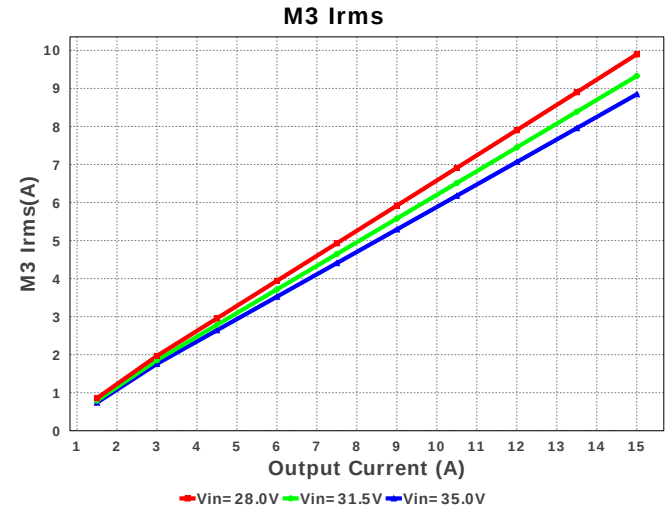


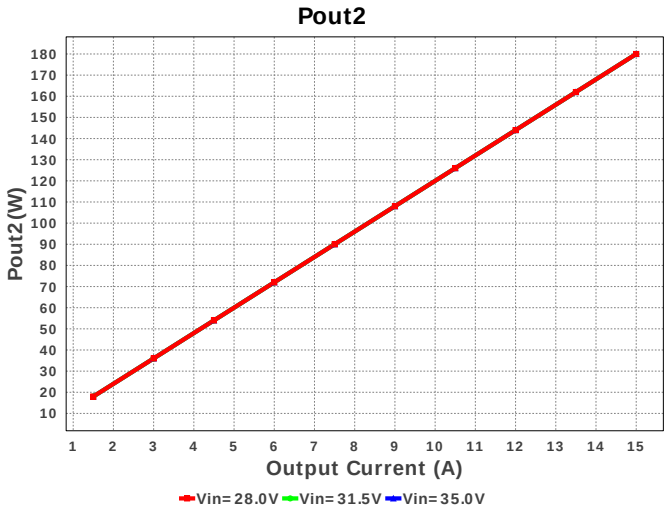


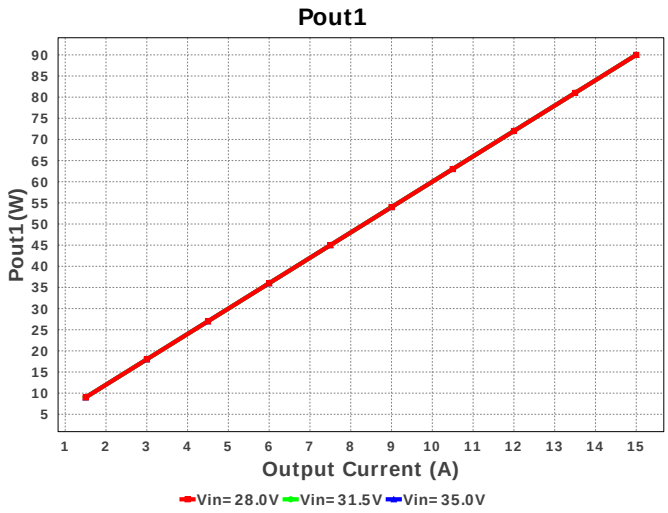


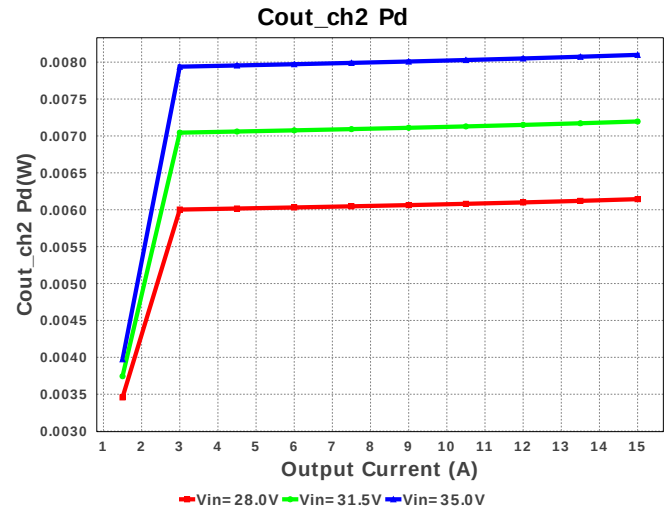


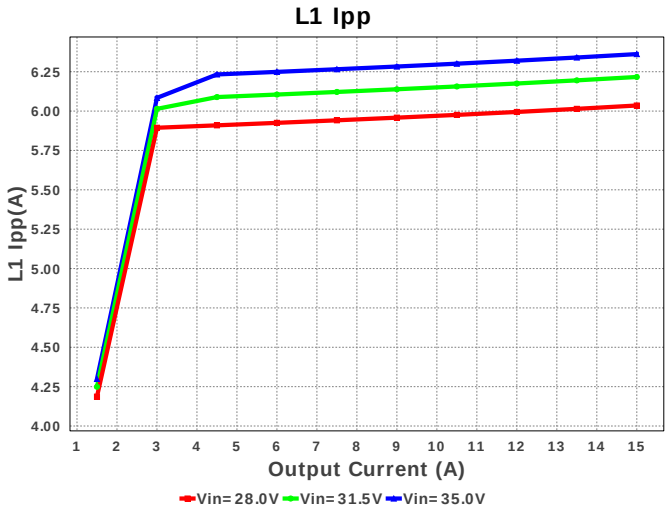


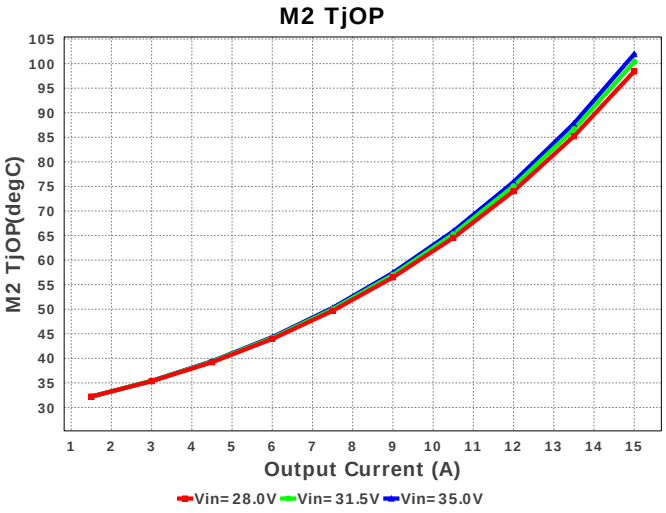


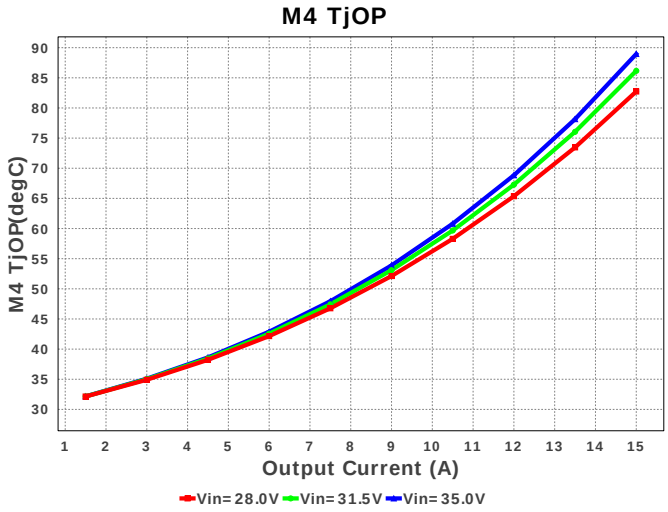


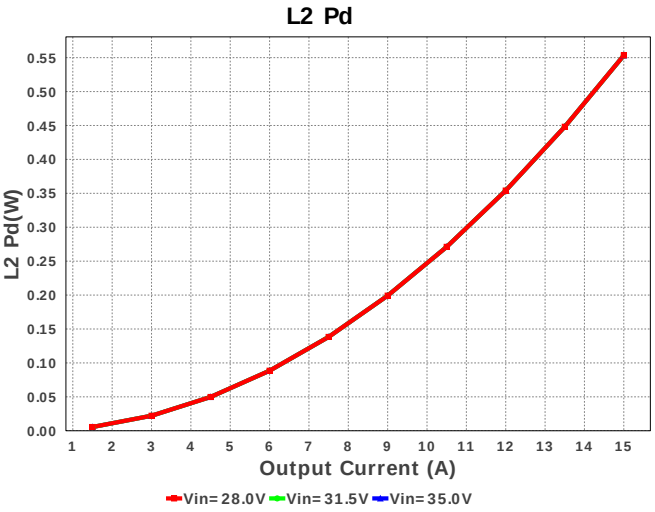


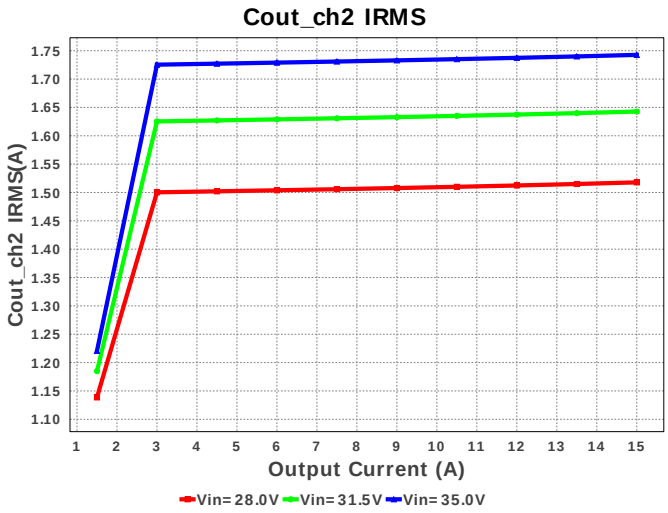


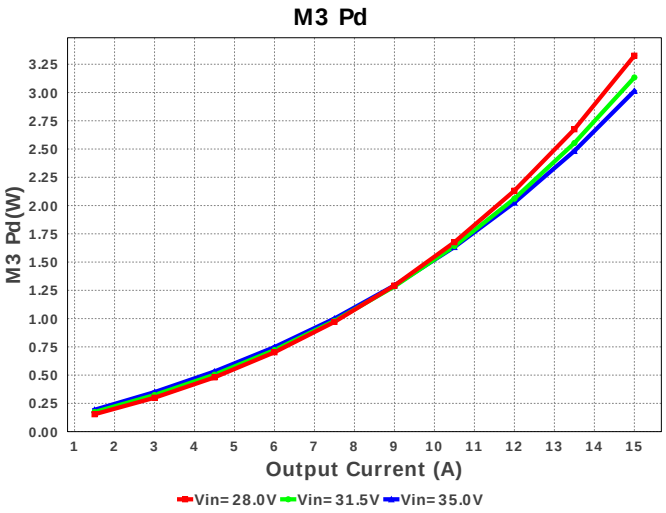


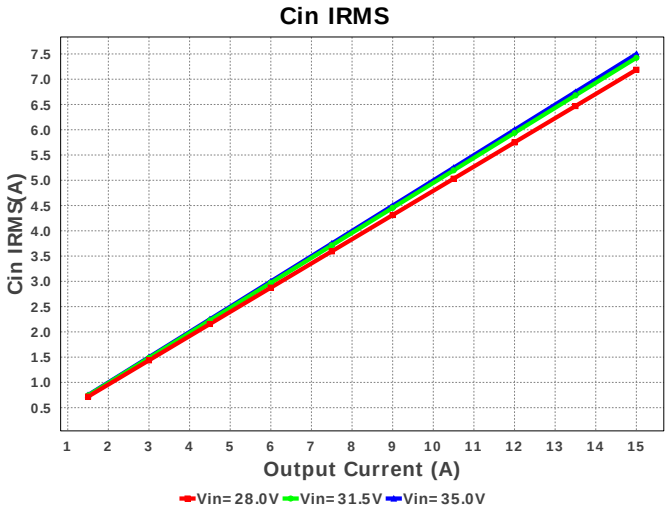












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	7.497 A	Current	Input capacitor RMS ripple current
2.	Cout_ch1 IRMS	1.837 A	Current	Output Channel 1 Capacitor RMS ripple current
3.	Cout_ch2 IRMS	1.743 A	Current	Output Channel 2 Capacitor RMS ripple current
4.	Iin Avg	8.044 A	Current	Average input current
5.	L1 Ipp	6.362 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	15.111 A	Current	Inductor ripple current
7.	L2Ipp	6.037 A	Current	Channel 2 Inductor Peak to peak Current
8.	L2 Irms	15.1 A	Current	Inductor ripple current
9.	M1 Irms	6.316 A	Current	MOSFET RMS ripple current
10.	M2 Irms	13.605 A	Current	MOSFET RMS ripple current
11.	M3 Irms	8.846 A	Current	MOSFET RMS ripple current
12.	M4 Irms	12.114 A	Current	MOSFET RMS ripple current
13.	SW1 Ipk	18.181 A	Current	Peak switch current
14.	SW2 Ipk	18.018 A	Current	Peak switch current
15.	BOM Count	56	General	Total Design BOM count
16.	FootPrint	2.113 k mm^2	General	Total Foot Print Area of BOM components
17.	Frequency	132.491 kHz	General	Switching frequency
18.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
19.	Pout1	90.0 W	General	Channel 1 output Power
20.	Pout2	180.0 W	General	Channel 2 output Power
21.	Total BOM	$0.0	General	Total BOM Cost
22.	Ch1 Mode	CCM	General	Conduction Mode
23.	Ch2 Mode	CCM	General	Conduction Mode
24.	M3 TjOP	91.06 degC	Op_Point	M3 MOSFET junction temperature
25.	M4 TjOP	88.954 degC	Op_Point	M4 MOSFET junction temperature
26.	Vout Actual	6.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
27.	Duty Cycle 1	17.73 %	Op_point	Duty cycle for Channel 1
28.	Duty Cycle 2	34.775 %	Op_point	Duty cycle for Channel 2
29.	Efficiency	95.901 %	Op_point	Steady state efficiency
30.	IC Tj	72.107 degC	Op_point	IC junction temperature
31.	IOUT1_OP	15.0 A	Op_point	Iout1 operating point
32.	IOUT2_OP	15.0 A	Op_point	Iout2 operating point
33.	M1 TjOP	99.554 degC	Op_point	M1 MOSFET junction temperature
34.	M2 TjOP	101.93 degC	Op_point	M2 MOSFET junction temperature
35.	VIN_OP	35.0 V	Op_point	Vin operating point
36.	Vout1 OP	6.0 V	Op_point	Operational Voltage 1
37.	Vout1 p-p	16.472 mV	Op_point	Peak-to-peak output1 ripple voltage
38.	Vout2 OP	12.0 V	Op_point	Operational Voltage 2
39.	Vout2 p-p	17.567 mV	Op_point	Peak-to-peak output2 ripple voltage
40.	Cin Pd	49.497 mW	Power	Input capacitor power dissipation
41.	Cout_ch1 Pd	4.216 mW	Power	Ouput channel 1 capacitor power dissipation
42.	Cout_ch2 Pd	8.099 mW	Power	Ouput channel 2 capacitor power dissipation
43.	IC Pd	1.053 W	Power	IC power dissipation
44.	L1 Pd	1.66 W	Power	Inductor power dissipation
45.	L2 Pd	553.255 mW	Power	Inductor power dissipation
46.	M1 Pd	1.25 W	Power	M1 MOSFET total power dissipation
47.	M1 PdCond	830.082 mW	Power	M1 MOSFET conduction losses
48.	M1 PdSw	419.609 mW	Power	M1 MOSFET switching losses
49.	M2 Pd	1.419 W	Power	M2 MOSFET total power dissipation
50.	M2 PdCond	1.043 W	Power	M2 MOSFET conduction losses
51.	M2 PdSw	376.499 mW	Power	M2 MOSFET switching losses
52.	M3 Pd	3.014 W	Power	M3 MOSFET total power dissipation

#	Name	Value	Category	Description
53.	M3 PdCond	1.879 W	Power	M3 MOSFET conduction losses
54.	M3 PdSw	1.134 W	Power	M3 MOSFET switching losses
55.	M1 Rdson	20.808 mOhm	Power	Drain-Source On-resistance
56.	M3 Rdson	24.021 mOhm	Power	Drain-Source On-resistance
57.	M4 Pd	1.164 W	Power	M4 MOSFET total power dissipation
58.	M4 PdCond	787.421 mW	Power	M4 MOSFET conduction losses
59.	M4 PdSw	376.446 mW	Power	M4 MOSFET switching losses
60.	M2 Rdson	5.634 mOhm	Power	Drain-Source On-resistance
61.	M4 Rdson	5.366 mOhm	Power	Drain-Source On-resistance
62.	Rsense1 Pd	925.54 mW	Power	Current Limit Sense Resistor Power Dissipation
63.	Rsense2 Pd	440.267 mW	Power	Current Limit Sense Resistor Power Dissipation
64.	Total Pd	11.54 W	Power	Total Power Dissipation
65.	Cross Freq Ch1	12.517 kHz		Bode plot crossover frequency
66.	Cross Freq Ch2	12.774 kHz		Bode plot crossover frequency
67.	Phase Marg Ch1	69.115 deg		Bode Plot Phase Margin
68.	Phase Marg Ch2	69.47 deg		Bode Plot Phase Margin
69.	Vout Tolerance	3.277 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	15.0	Maximum Output Current
2.	Iout1	15.0	Output Current #1
3.	Iout2	15.0	Output Current #2
4.	VinMax	35.0	Maximum input voltage
5.	VinMin	28.0	Minimum input voltage
6.	Vout	6.0	Output Voltage
7.	Vout1	6.0	Output Voltage #1
8.	Vout2	12.0	Output Voltage #2
9.	base_pn	LM25119	Base Product Number
10.	source	DC	Input Source Type
11.	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. Sequencing the 2 outputs The LM(2)5119 contains an enable function allowing shutdown control of channel2, independent of channel1. If the EN2 pin is pulled below 2.0V, channel2 enters shutdown mode. If the EN2 input is greater than 2.5V, channel2 returns to normal operation. 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.