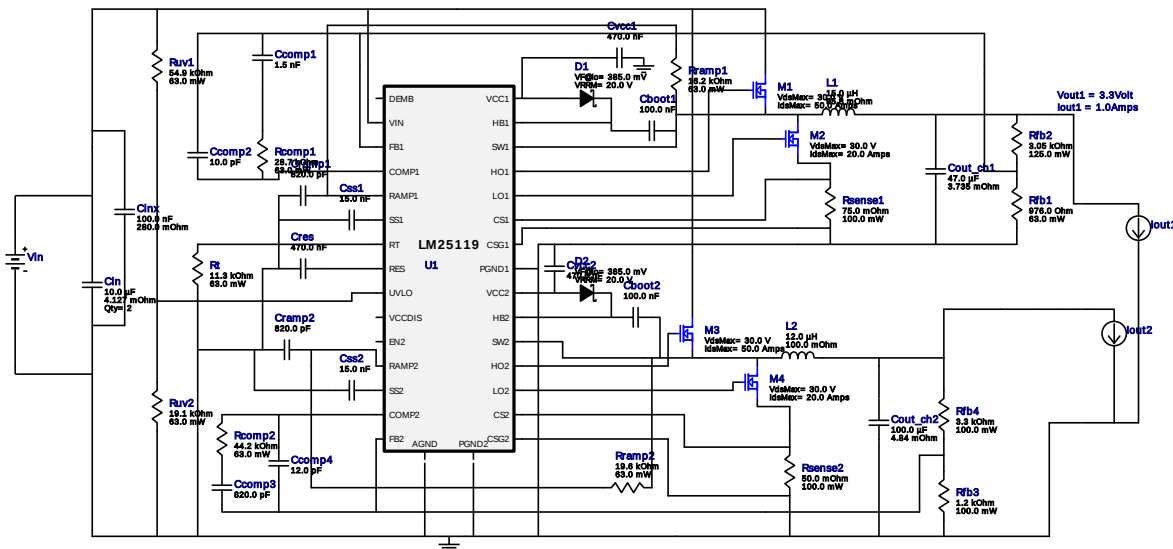


WEBENCH® Design Report

Design : 4765003/2 LM25119PSQ/NOPB
LM25119PSQ/NOPB 6.0V-11.0V to 3.00V @ 1.0A



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.

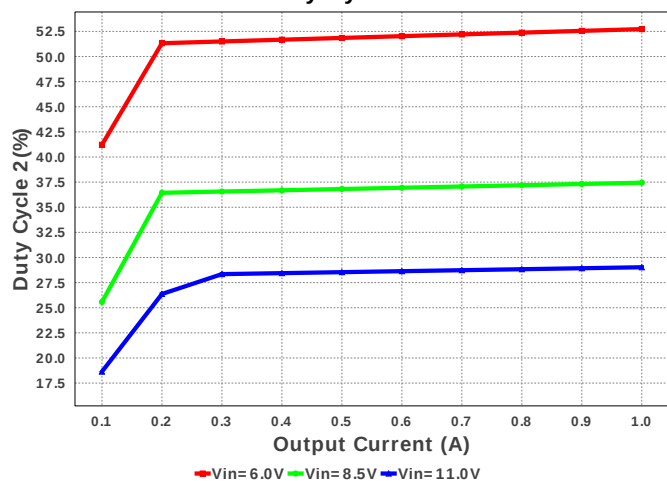
Electrical BOM

#	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 mm ²
2.	Cboot2	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
3.	Ccomp1	Yageo America	CC0805KRX7R9BB152 Series= X7R	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Ccomp2	Kemet	C0805C100K5GACTU Series= C0G/NP0	Cap= 10.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Ccomp3	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Ccomp4	Yageo America	CC0805JRNPO9BN120 Series= C0G/NP0	Cap= 12.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
7.	Cin	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	2	\$0.03	0805 7 mm ²
8.	Cinx	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²

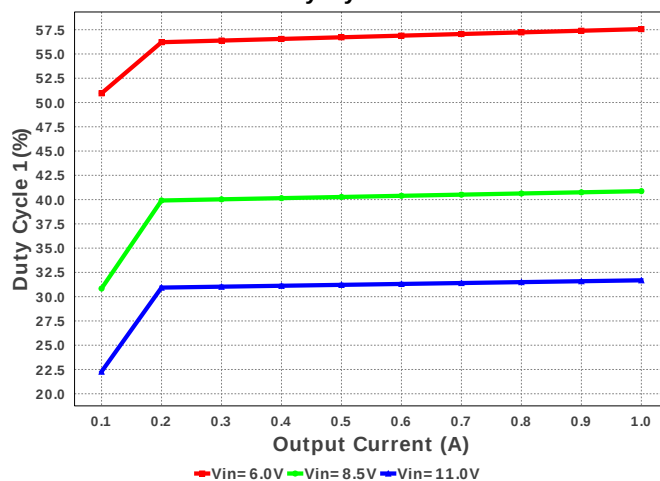
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cout_ch1	MuRata	GRM31CC80J476KE18L Series= X6S	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.0522 A	1	\$0.10	 1206_190 11 mm ²
10.	Cout_ch2	MuRata	GRM31CD80G107ME39L Series= X6T	Cap= 100.0 uF ESR= 4.84 mOhm VDC= 4.0 V IRMS= 4.3381 A	1	\$0.14	 1206_190 11 mm ²
11.	Cramp1	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
12.	Cramp2	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
13.	Cres	MuRata	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
14.	Css1	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
15.	Css2	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
16.	Cvcc1	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
17.	Cvcc2	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
18.	D1	ON Semiconductor	MBR0520LT1G	VF@Io= 385.0 mV VRRM= 20.0 V	1	\$0.06	 SOD-123 13 mm ²
19.	D2	ON Semiconductor	MBR0520LT1G	VF@Io= 385.0 mV VRRM= 20.0 V	1	\$0.06	 SOD-123 13 mm ²
20.	L1	Bourns	SRN6045-150M	L= 15.0 uH DCR= 95.8 mOhm	1	\$0.16	 SRN6045 64 mm ²
21.	L2	NIC Components	NPI54C120MTRF	L= 12.0 uH DCR= 100.0 mOhm	1	\$0.09	 IND_NPI54C 61 mm ²
22.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.28	 TRANS_NexFET_Q3 18 mm ²
23.	M2	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	\$0.19	 TRANS_NexFET_Q3A 18 mm ²
24.	M3	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.28	 TRANS_NexFET_Q3 18 mm ²
25.	M4	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	\$0.19	 TRANS_NexFET_Q3A 18 mm ²
26.	Rcomp1	Vishay-Dale	CRCW040228K7FKED Series= CRCW..e3	Res= 28.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
27.	Rcomp2	Vishay-Dale	CRCW040244K2FKED Series= CRCW..e3	Res= 44.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	Rfb1	Vishay-Dale	CRCW0402976RFKED Series= CRCW..e3	Res= 976.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
29.	Rfb2	Yageo America	RT0805BRD073K05L Series= ?	Res= 3.05 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.04	 0805 7 mm ²
30.	Rfb3	Yageo America	RC0603FR-071K2L Series= ?	Res= 1.2 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
31.	Rfb4	Yageo America	RC0603FR-073K3L Series= ?	Res= 3.3 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
32.	Rramp1	Vishay-Dale	CRCW040216K2FKED Series= CRCW..e3	Res= 16.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
33.	Rramp2	Vishay-Dale	CRCW040219K6FKED Series= CRCW..e3	Res= 19.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
34.	Rsense1	Panasonic	ERJ-L03UF75MV Series= ERJ-L03	Res= 75.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.09	 0603 5 mm ²
35.	Rsense2	Panasonic	ERJ-L03KF50MV Series= ERJ-L03	Res= 50.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.09	 0603 5 mm ²
36.	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
37.	Ruv1	Vishay-Dale	CRCW040254K9FKED Series= CRCW..e3	Res= 54.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
38.	Ruv2	Vishay-Dale	CRCW040219K1FKED Series= CRCW..e3	Res= 19.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
39.	U1	Texas Instruments	LM25119PSQ/NOPB	Switcher	1	\$2.60	 SQA32A 49 mm ²

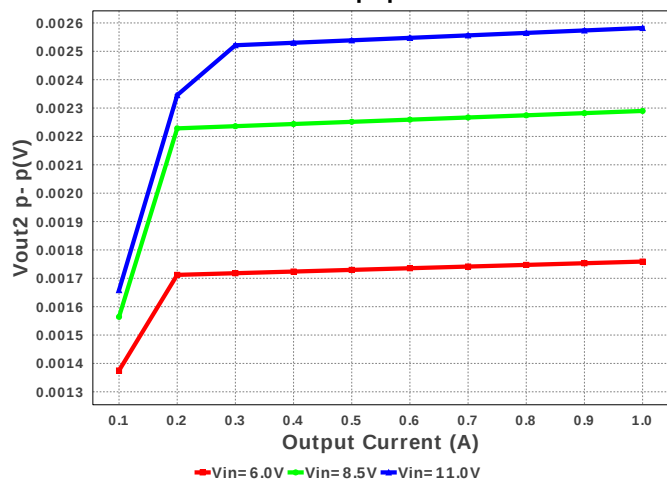
Duty Cycle 2



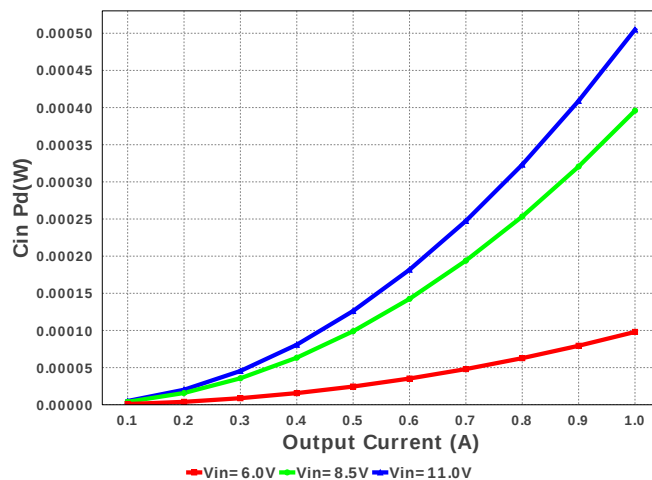
Duty Cycle 1



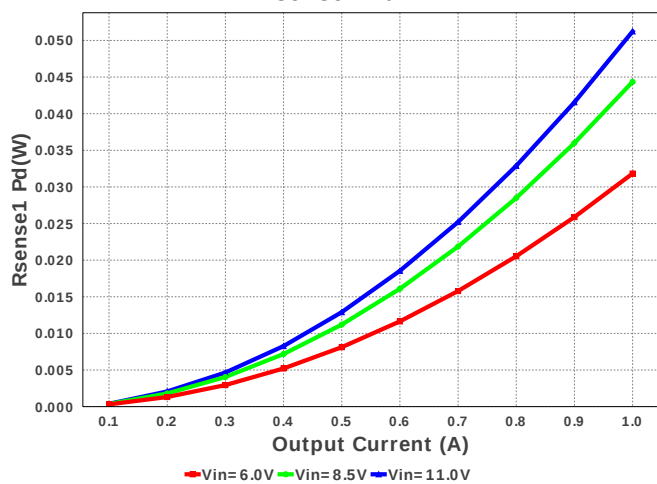
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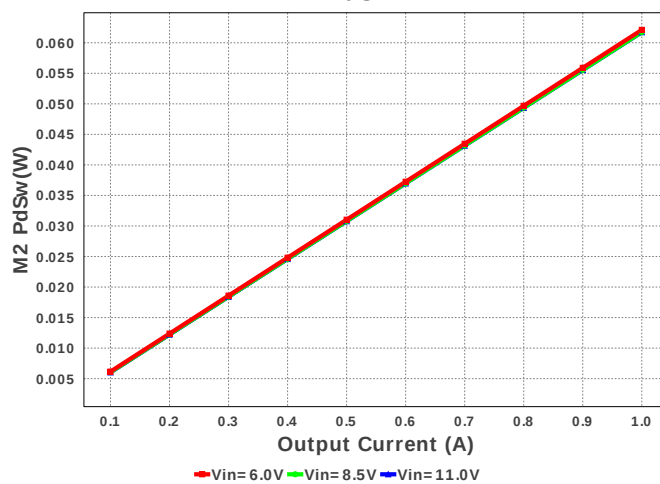
Cin Pd

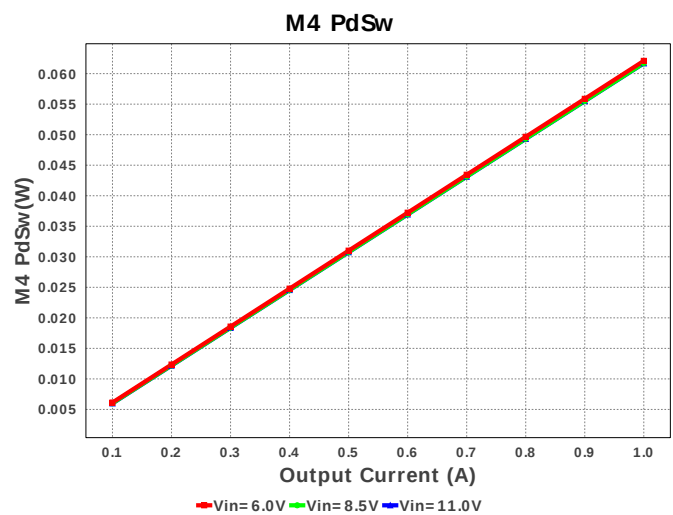
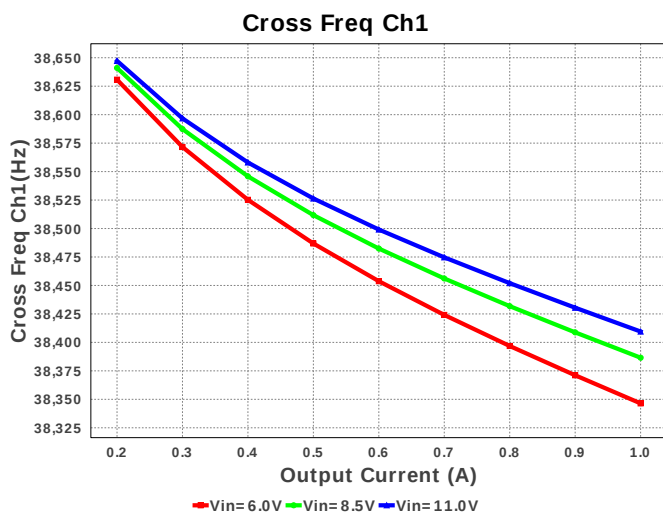
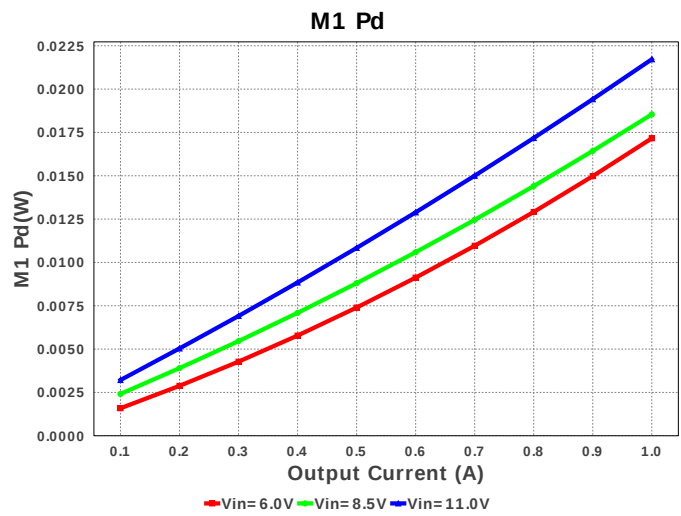
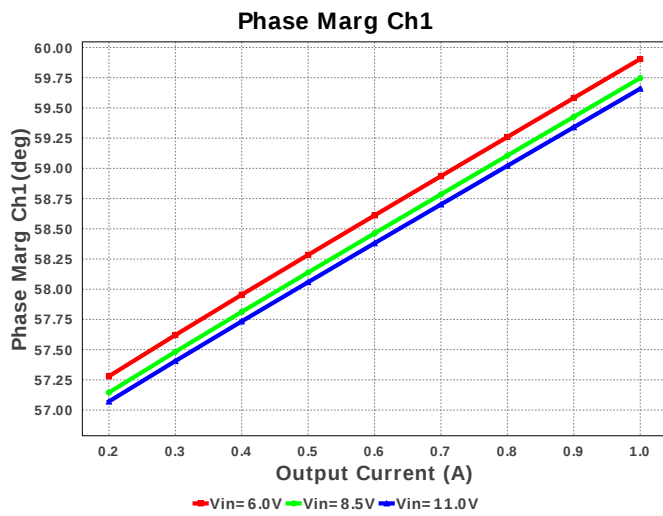
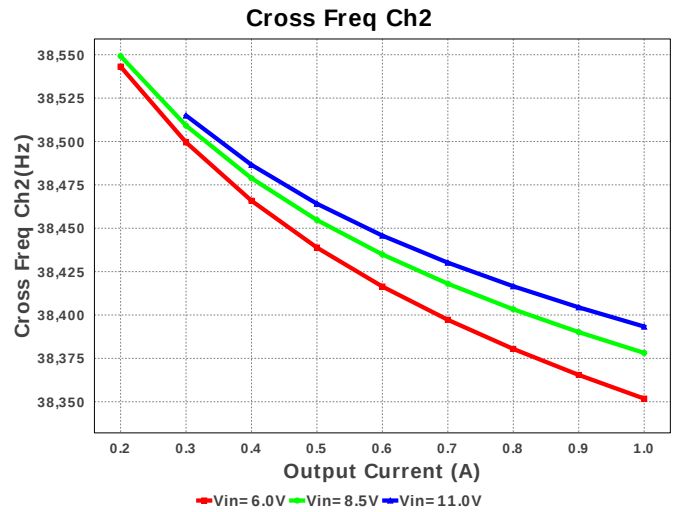
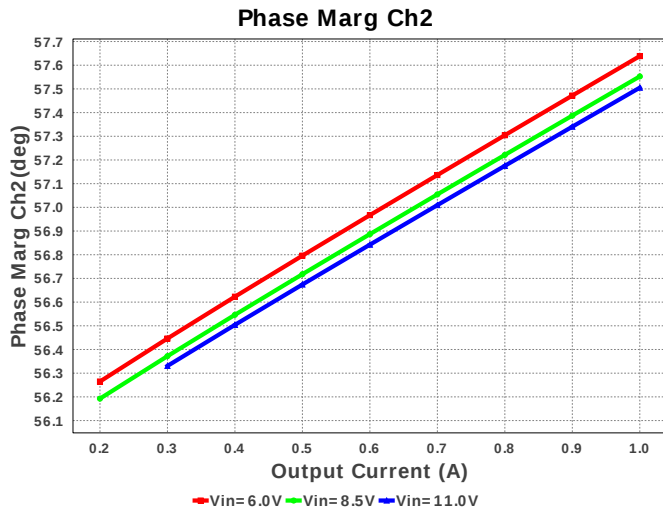


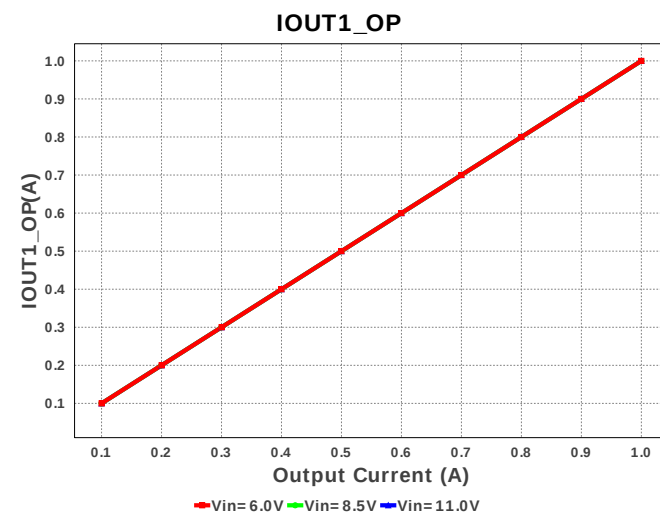
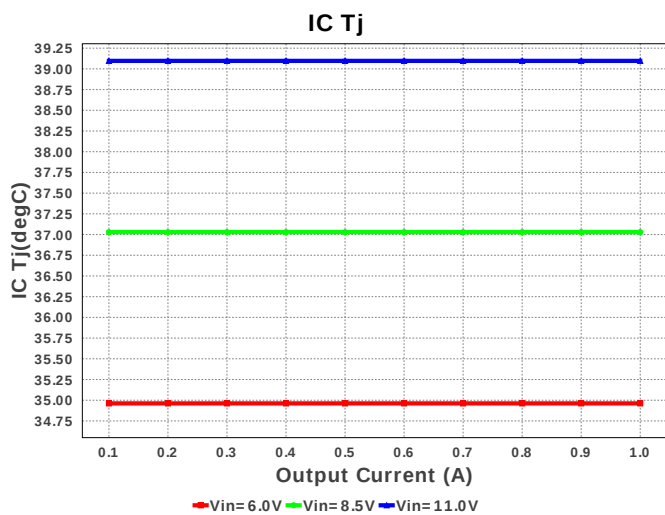
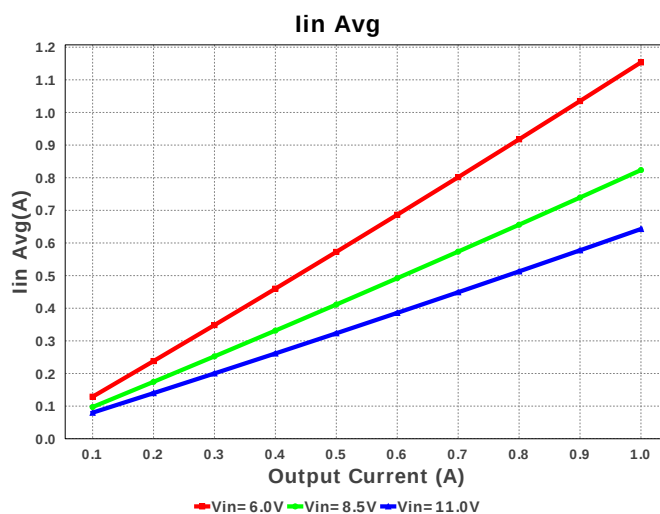
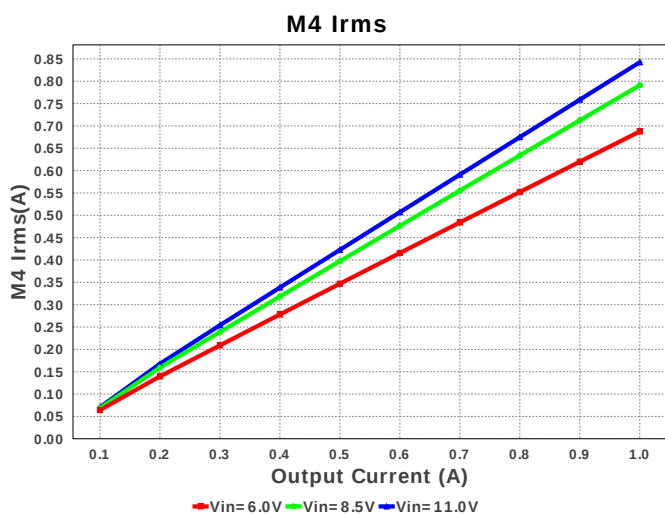
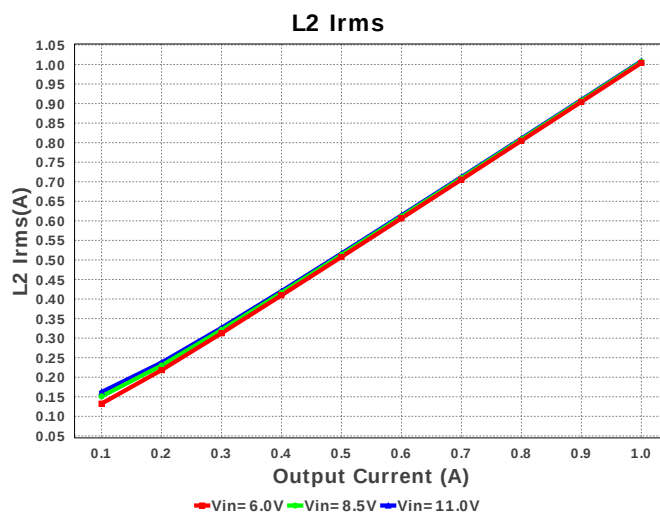
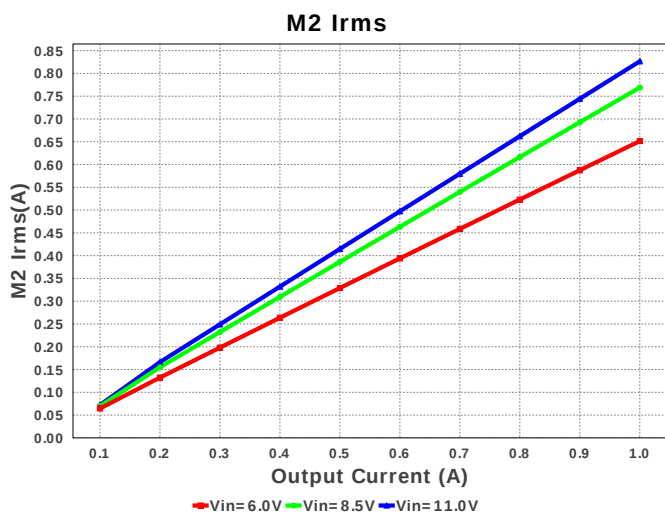
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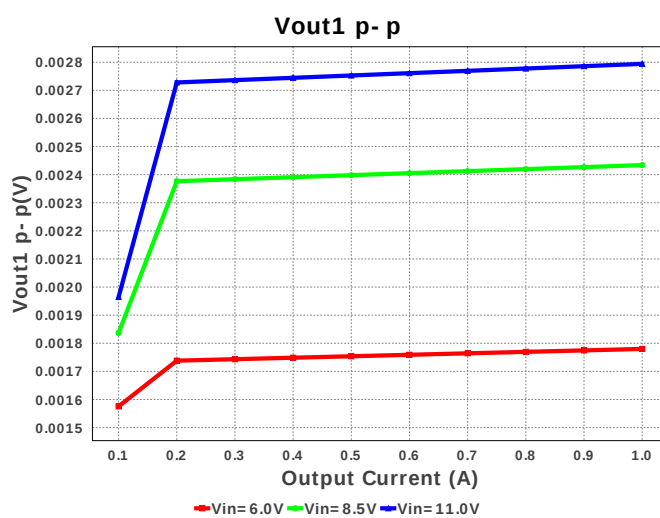
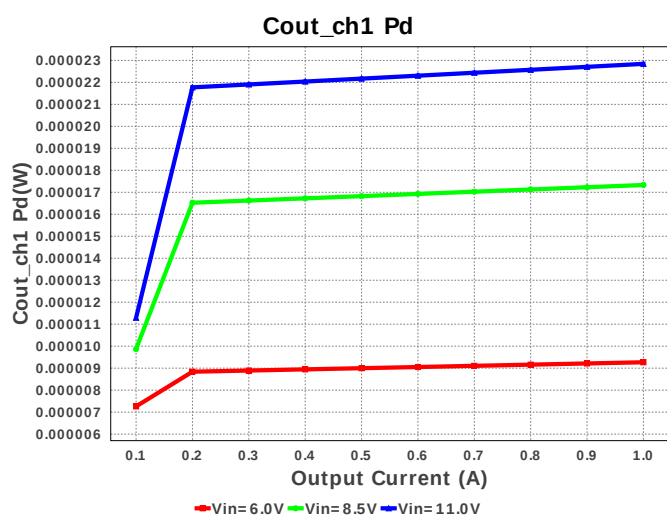
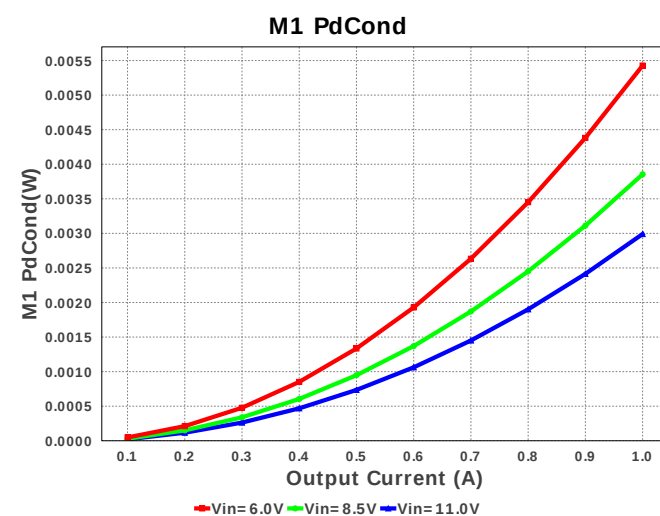
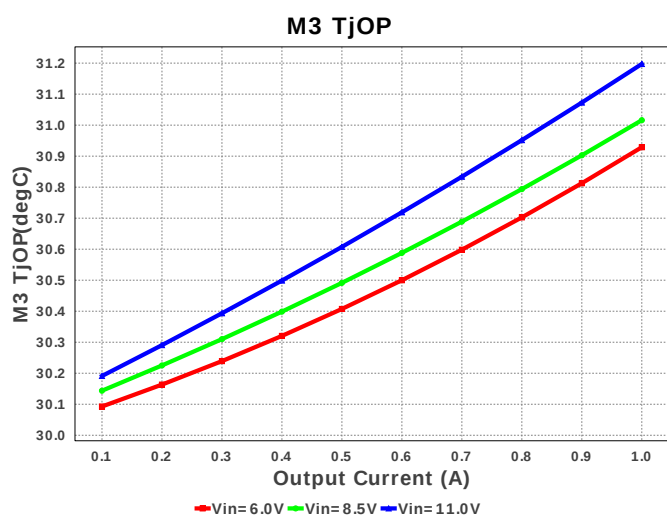
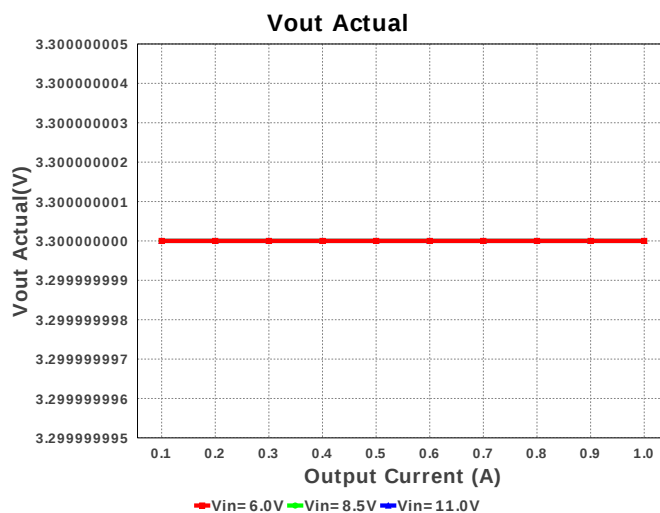
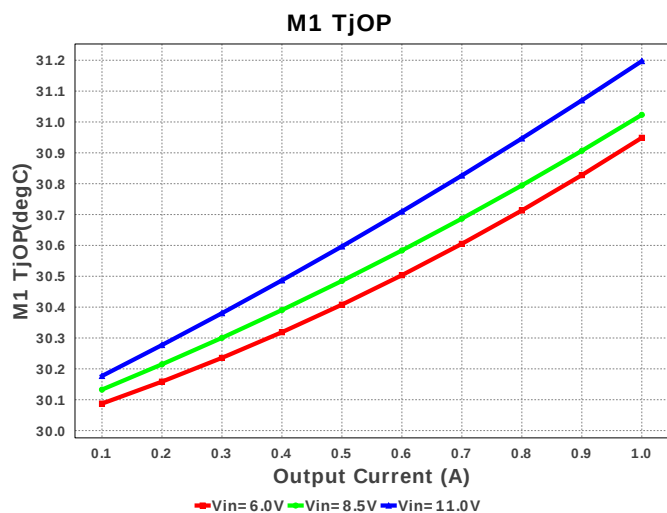


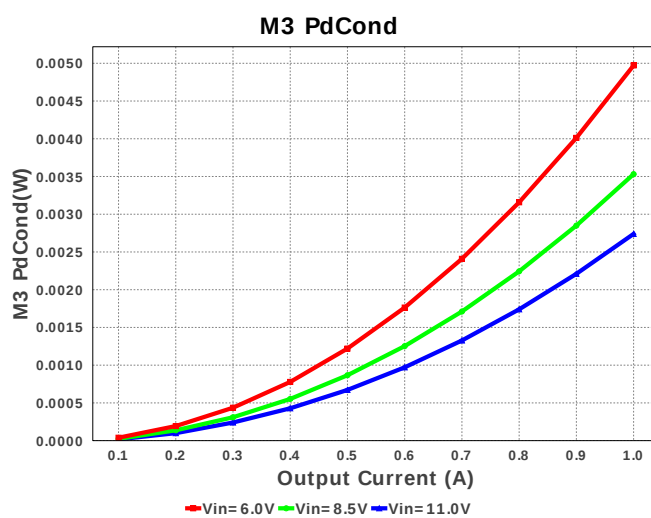
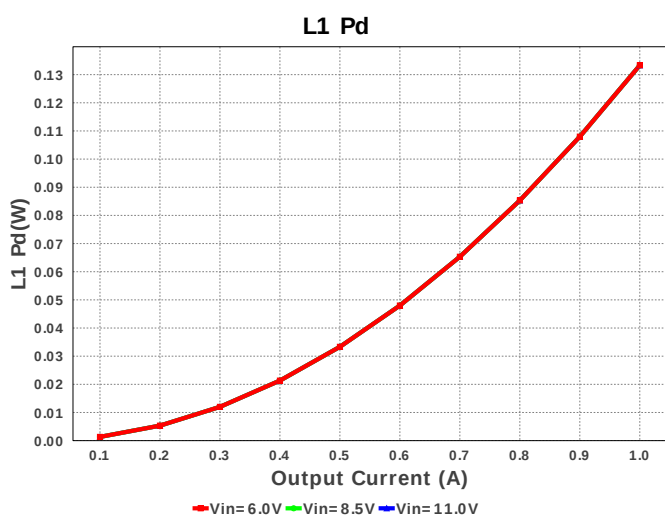
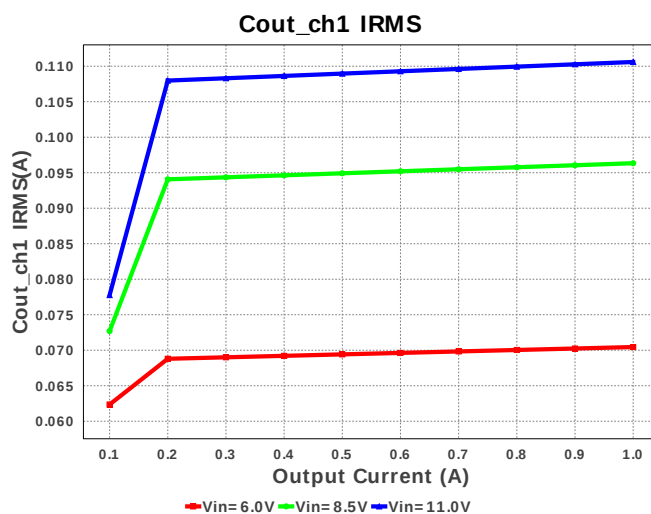
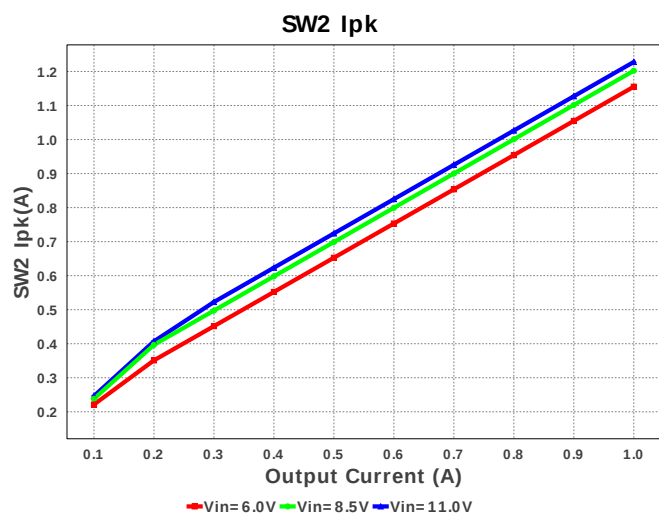
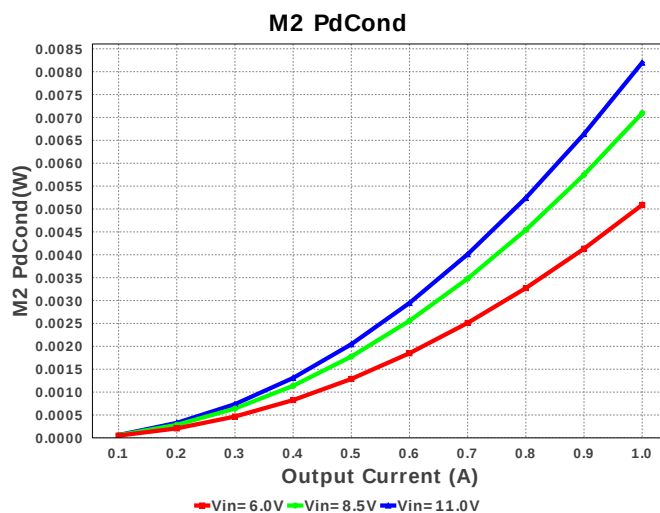
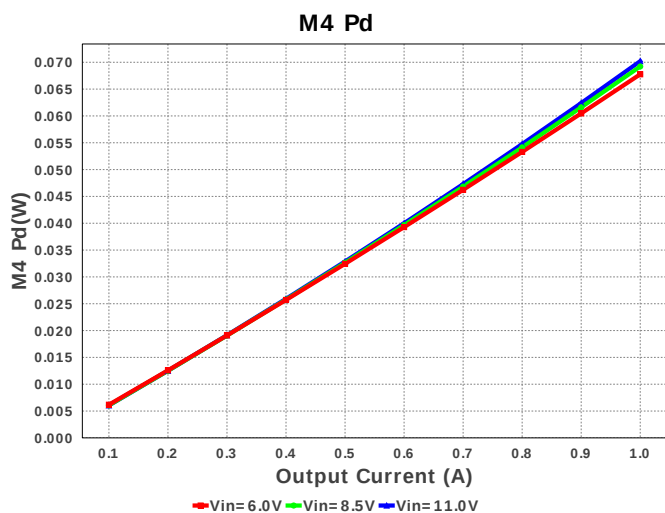
M2 PdSw

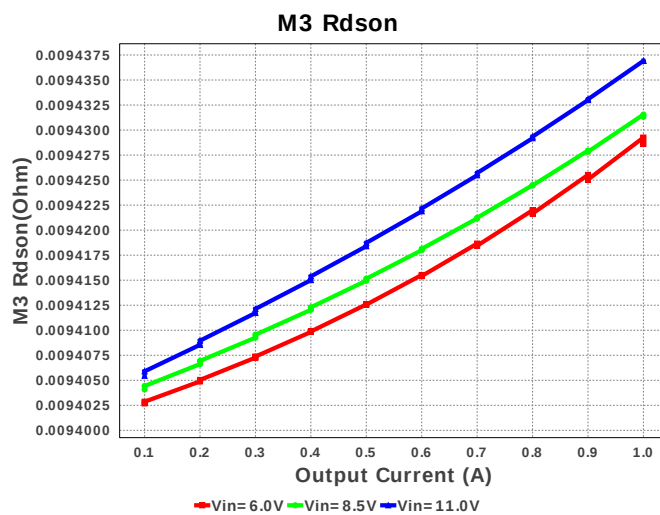
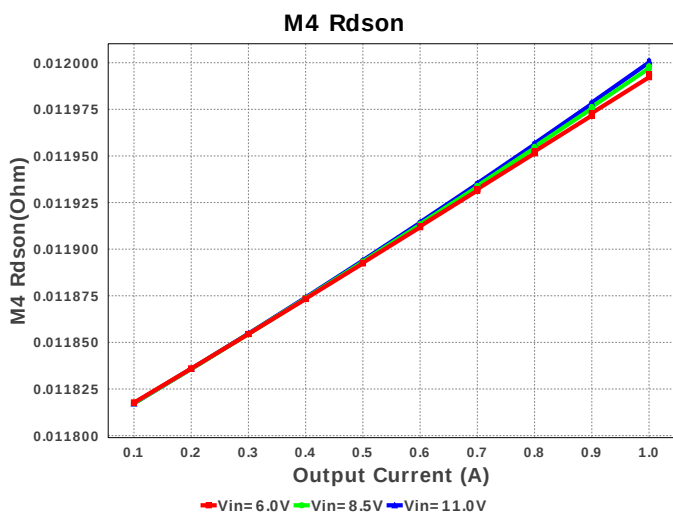
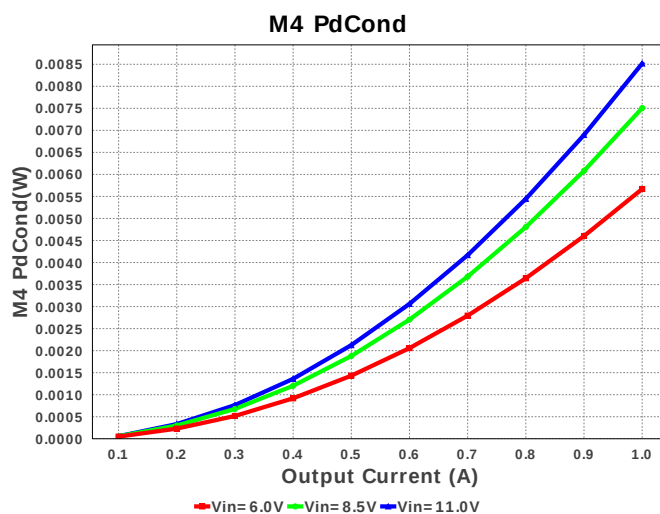
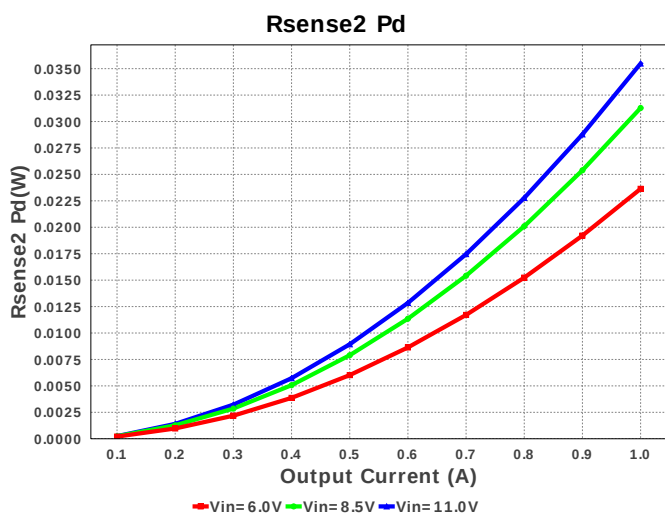
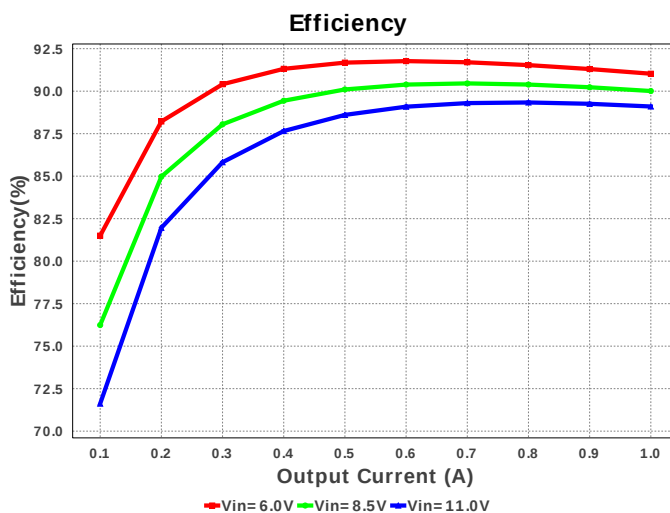
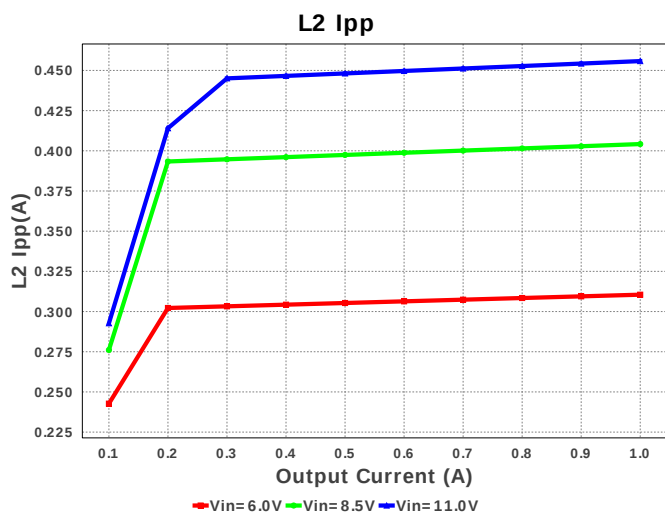


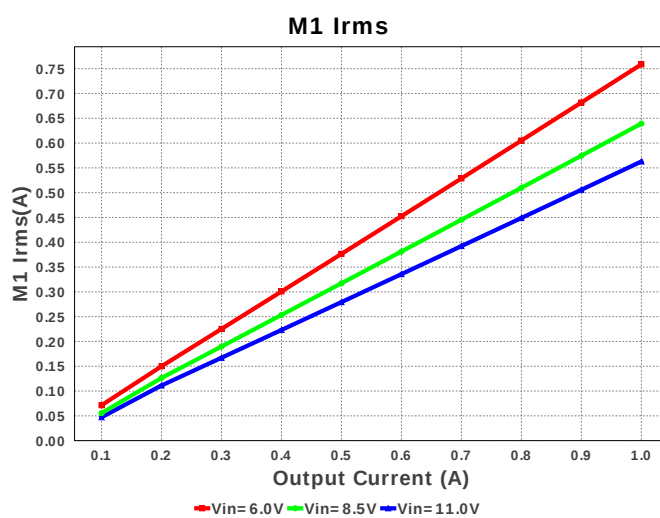
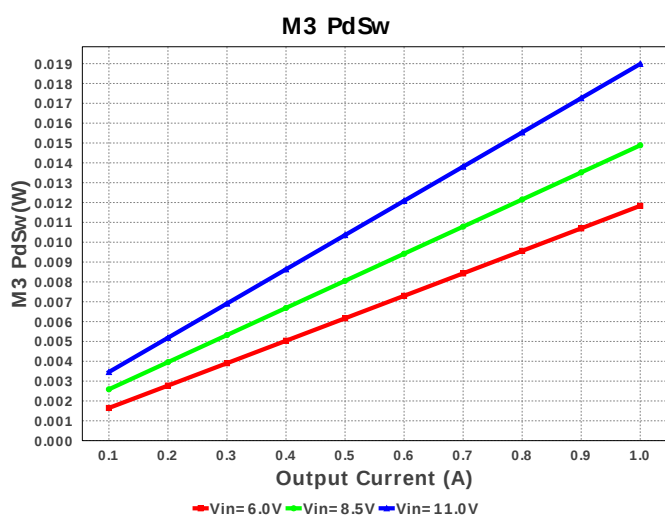
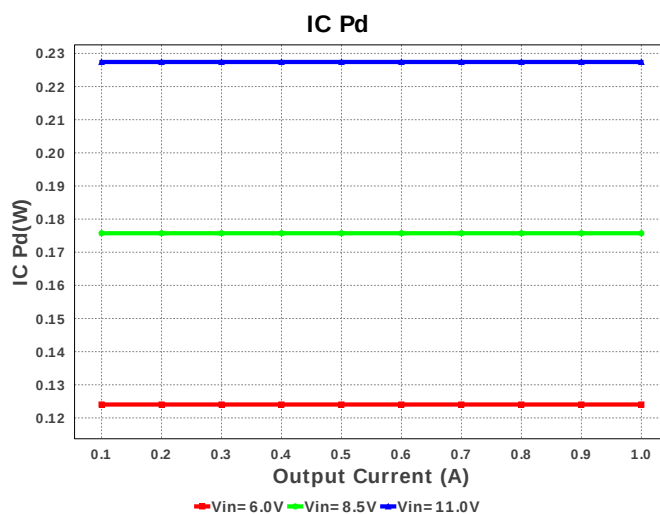
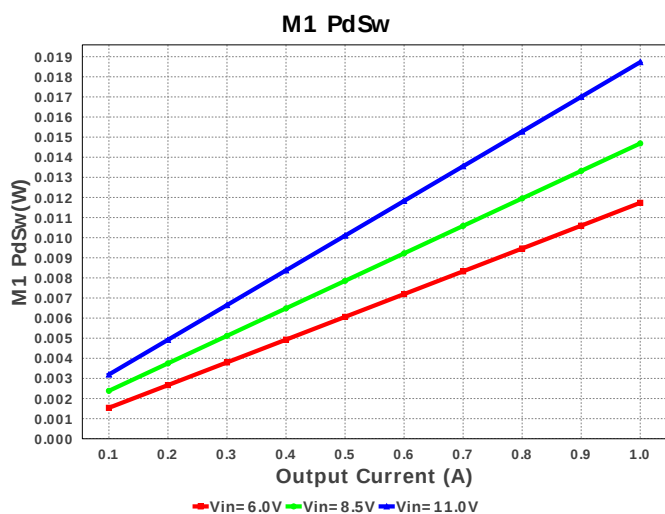
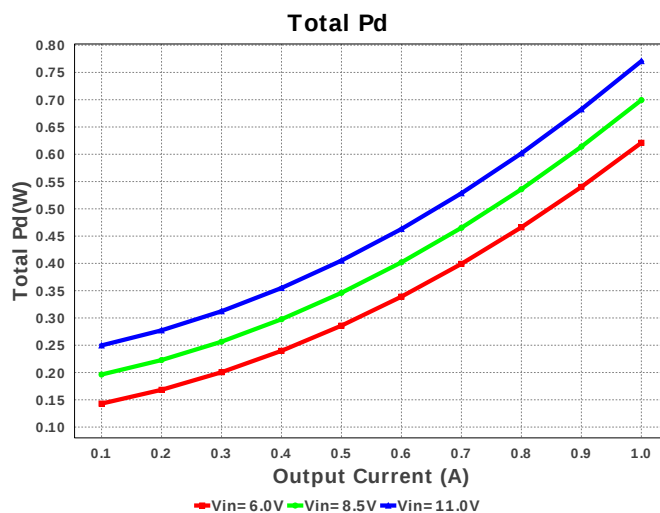
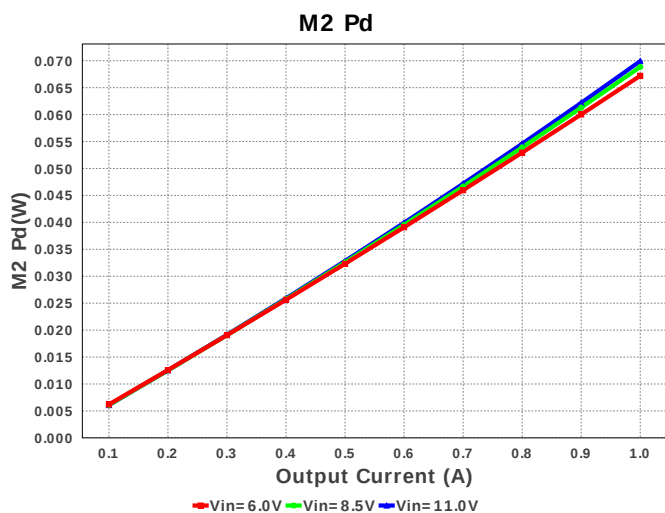


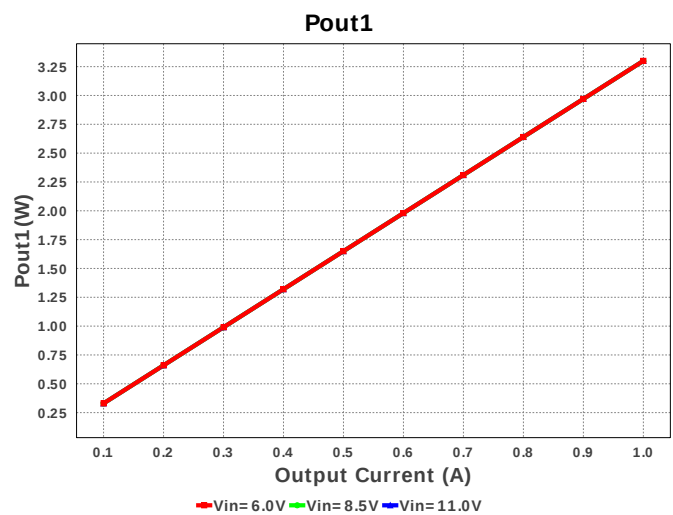
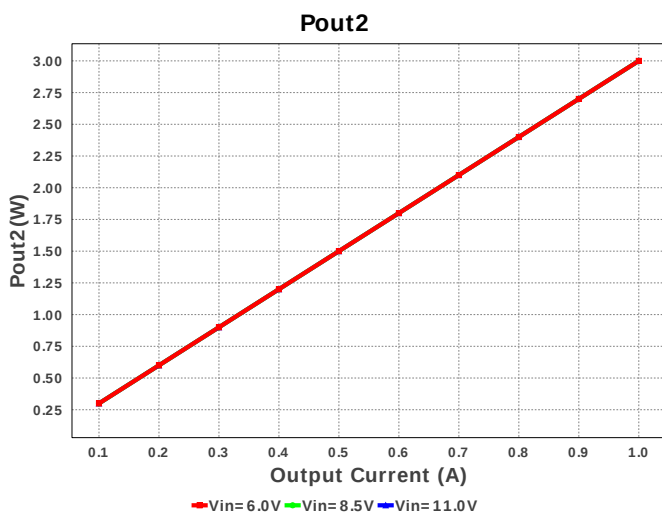
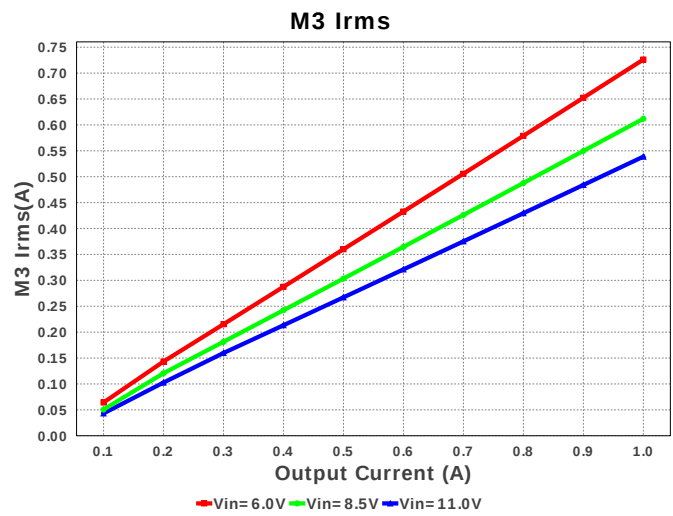
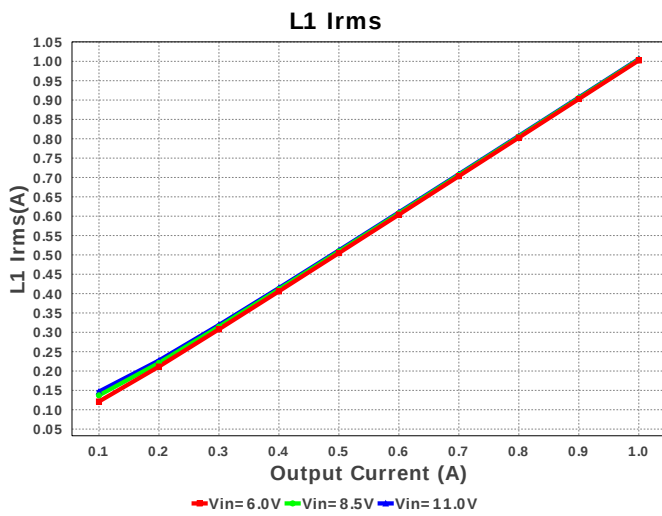
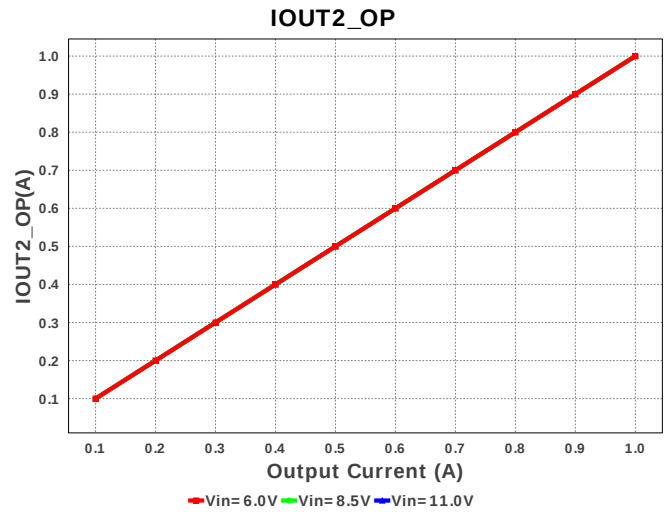
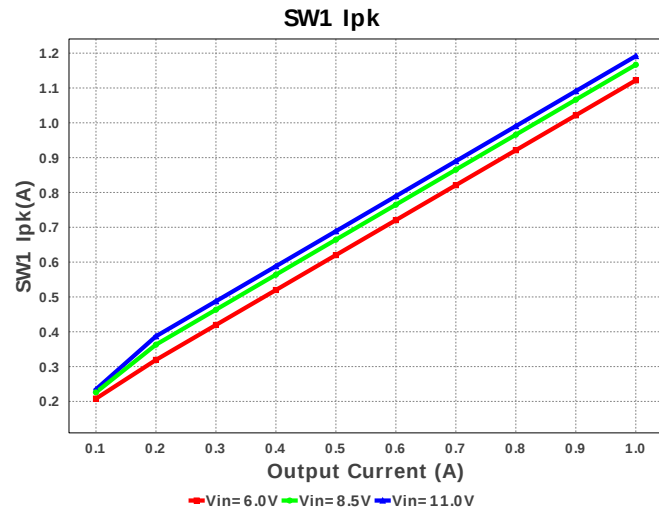


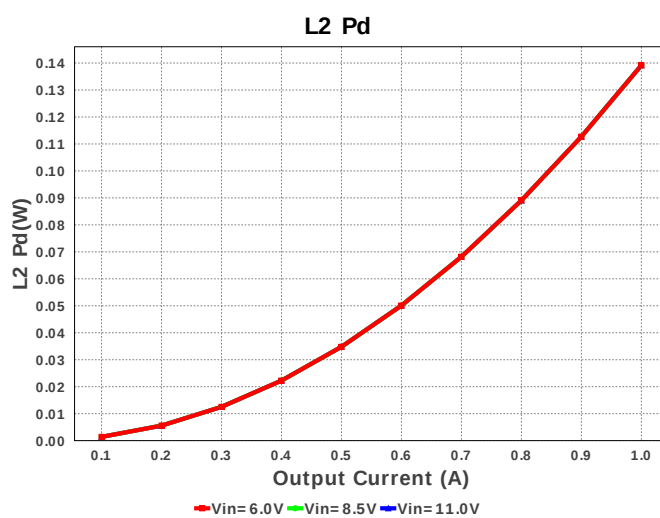
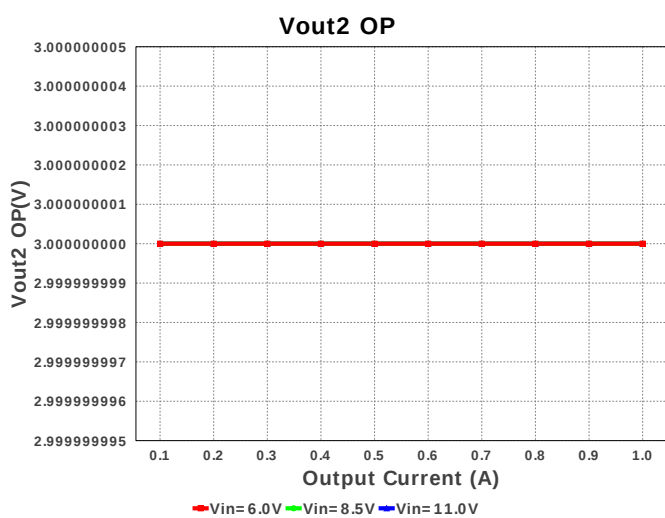
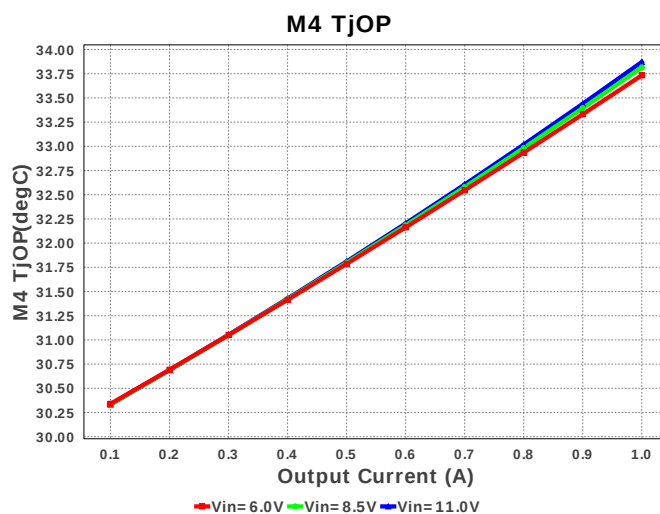
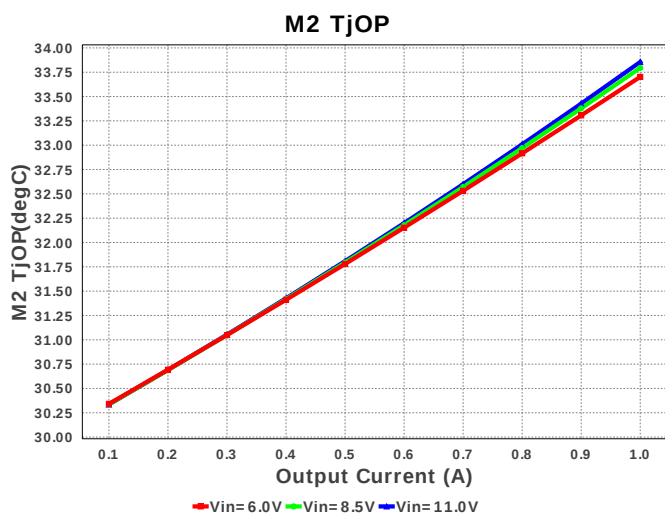
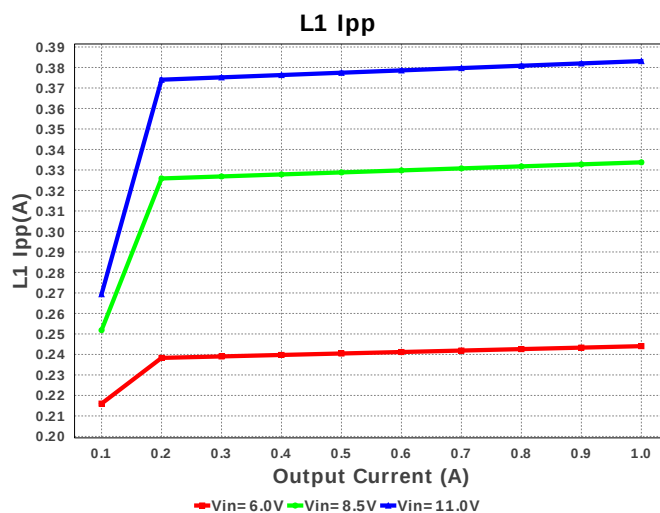
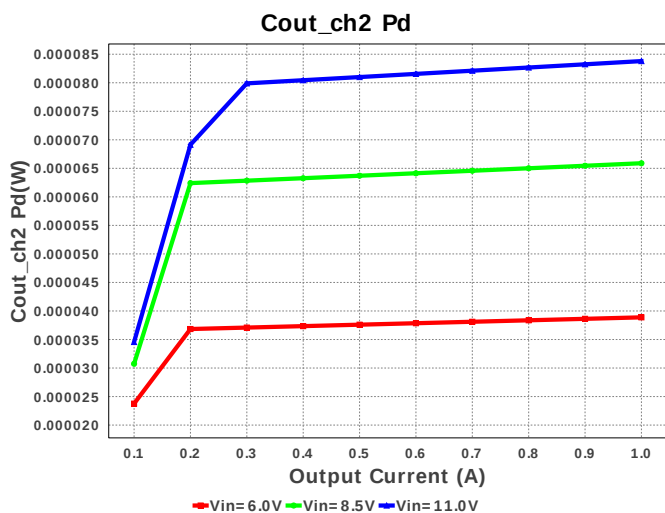


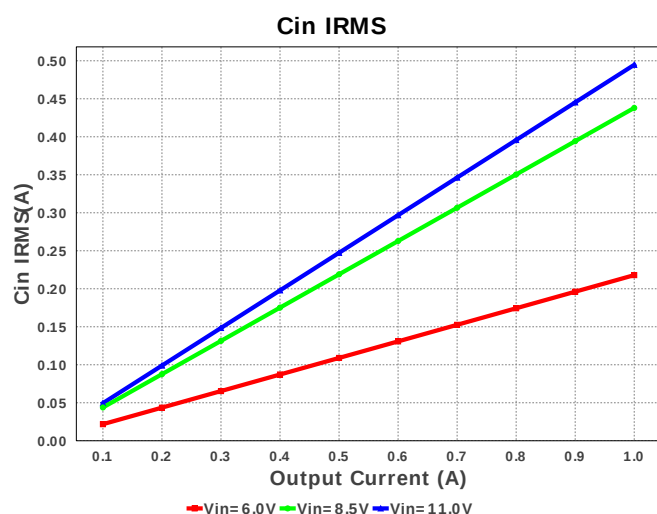
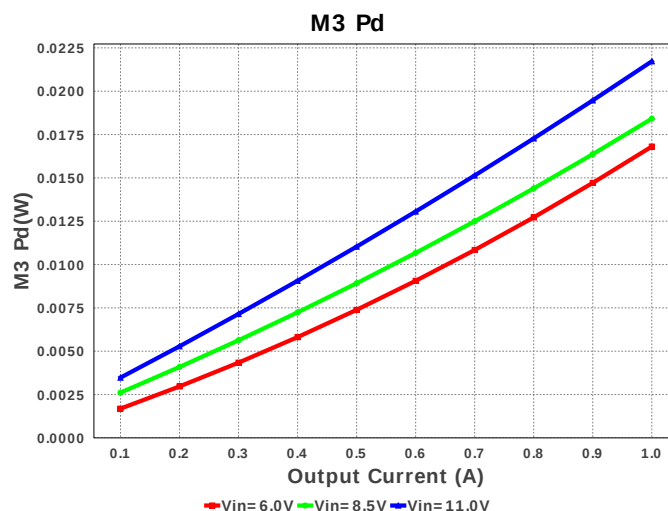
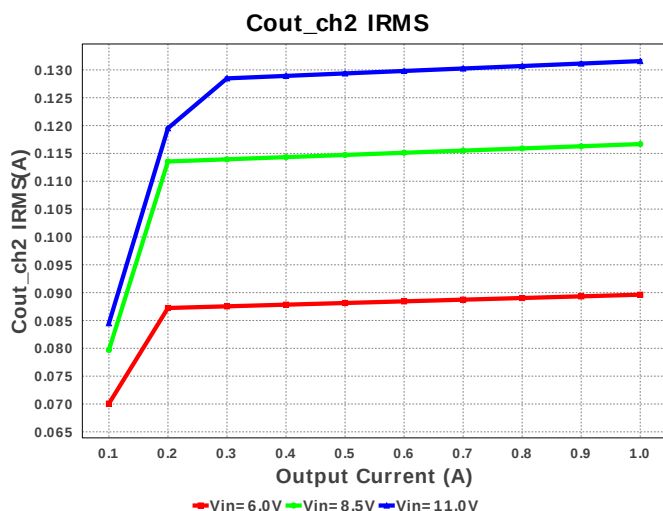












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	494.682 mA	Current	Input capacitor RMS ripple current
2.	Cout_ch1 IRMS	110.596 mA	Current	Output Channel 1 Capacitor RMS ripple current
3.	Cout_ch2 IRMS	131.58 mA	Current	Output Channel 2 Capacitor RMS ripple current
4.	Iin Avg	642.8 mA	Current	Average input current
5.	L1 Ipp	383.116 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	1.006 A	Current	Inductor ripple current
7.	L2Ipp	455.806 mA	Current	Channel 2 Inductor Peak to peak Current
8.	L2 Irms	1.009 A	Current	Inductor ripple current
9.	M1 Irms	562.904 mA	Current	MOSFET RMS ripple current
10.	M2 Irms	826.522 mA	Current	MOSFET RMS ripple current
11.	M3 Irms	538.771 mA	Current	MOSFET RMS ripple current
12.	M4 Irms	842.452 mA	Current	MOSFET RMS ripple current
13.	SW1 Ipk	1.192 A	Current	Peak switch current
14.	SW2 Ipk	1.228 A	Current	Peak switch current
15.	BOM Count	40	General	Total Design BOM count
16.	FootPrint	434.0 mm ²	General	Total Foot Print Area of BOM components
17.	Frequency	424.559 kHz	General	Switching frequency
18.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
19.	Pout1	3.3 W	General	Channel 1 output Power
20.	Pout2	3.0 W	General	Channel 2 output Power
21.	Total BOM	\$4.67	General	Total BOM Cost
22.	Ch1 Mode	CCM	General	Conduction Mode
23.	Ch2 Mode	CCM	General	Conduction Mode
24.	M3 TjOP	31.197 degC	Op_Point	M3 MOSFET junction temperature
25.	M4 TjOP	33.871 degC	Op_Point	M4 MOSFET junction temperature
26.	Vout Actual	3.3 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
27.	Duty Cycle 1	31.686 %	Op_point	Duty cycle for Channel 1
28.	Duty Cycle 2	29.027 %	Op_point	Duty cycle for Channel 2
29.	Efficiency	89.099 %	Op_point	Steady state efficiency
30.	IC Tj	39.097 degC	Op_point	IC junction temperature
31.	IOUT1_OP	1.0 A	Op_point	Iout1 operating point

#	Name	Value	Category	Description
32.	IOUT2_OP	1.0 A	Op_point	Iout2 operating point
33.	M1 TjOP	31.197 degC	Op_point	M1 MOSFET junction temperature
34.	M2 TjOP	33.855 degC	Op_point	M2 MOSFET junction temperature
35.	VIN_OP	11.0 V	Op_point	Vin operating point
36.	Vout1 OP	3.3 V	Op_point	Operational Voltage 1
37.	Vout1 p-p	2.794 mV	Op_point	Peak-to-peak output1 ripple voltage
38.	Vout2 OP	3.0 V	Op_point	Operational Voltage 2
39.	Vout2 p-p	2.582 mV	Op_point	Peak-to-peak output2 ripple voltage
40.	Cin Pd	504.961 μ W	Power	Input capacitor power dissipation
41.	Cout_ch1 Pd	22.842 μ W	Power	Output channel 1 capacitor power dissipation
42.	Cout_ch2 Pd	83.796 μ W	Power	Output channel 2 capacitor power dissipation
43.	IC Pd	227.417 mW	Power	IC power dissipation
44.	L1 Pd	133.308 mW	Power	Inductor power dissipation
45.	L2 Pd	139.152 mW	Power	Inductor power dissipation
46.	M1 Pd	21.719 mW	Power	M1 MOSFET total power dissipation
47.	M1 PdCond	2.99 mW	Power	M1 MOSFET conduction losses
48.	M1 PdSw	18.729 mW	Power	M1 MOSFET switching losses
49.	M2 Pd	69.917 mW	Power	M2 MOSFET total power dissipation
50.	M2 PdCond	8.198 mW	Power	M2 MOSFET conduction losses
51.	M2 PdSw	61.72 mW	Power	M2 MOSFET switching losses
52.	M3 Pd	21.723 mW	Power	M3 MOSFET total power dissipation
53.	M3 PdCond	2.739 mW	Power	M3 MOSFET conduction losses
54.	M3 PdSw	18.984 mW	Power	M3 MOSFET switching losses
55.	M1 Rdson	9.437 mOhm	Power	Drain-Source On-resistance
56.	M3 Rdson	9.437 mOhm	Power	Drain-Source On-resistance
57.	M4 Pd	70.202 mW	Power	M4 MOSFET total power dissipation
58.	M4 PdCond	8.517 mW	Power	M4 MOSFET conduction losses
59.	M4 PdSw	61.685 mW	Power	M4 MOSFET switching losses
60.	M2 Rdson	12.0 mOhm	Power	Drain-Source On-resistance
61.	M4 Rdson	12.001 mOhm	Power	Drain-Source On-resistance
62.	Rsense1 Pd	51.235 mW	Power	Current Limit Sense Resistor Power Dissipation
63.	Rsense2 Pd	35.486 mW	Power	Current Limit Sense Resistor Power Dissipation
64.	Total Pd	770.772 mW	Power	Total Power Dissipation
65.	Cross Freq Ch1	38.412 kHz		Bode plot crossover frequency
66.	Cross Freq Ch2	38.395 kHz		Bode plot crossover frequency
67.	Phase Marg Ch1	59.652 deg		Bode Plot Phase Margin
68.	Phase Marg Ch2	57.5 deg		Bode Plot Phase Margin
69.	Vout Tolerance	2.354 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	Iout1	1.0	Output Current #1
3.	Iout2	1.0	Output Current #2
4.	VinMax	11.0	Maximum input voltage
5.	VinMin	6.0	Minimum input voltage
6.	Vout	3.3	Output Voltage
7.	Vout1	3.3	Output Voltage #1
8.	Vout2	3.0	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.

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