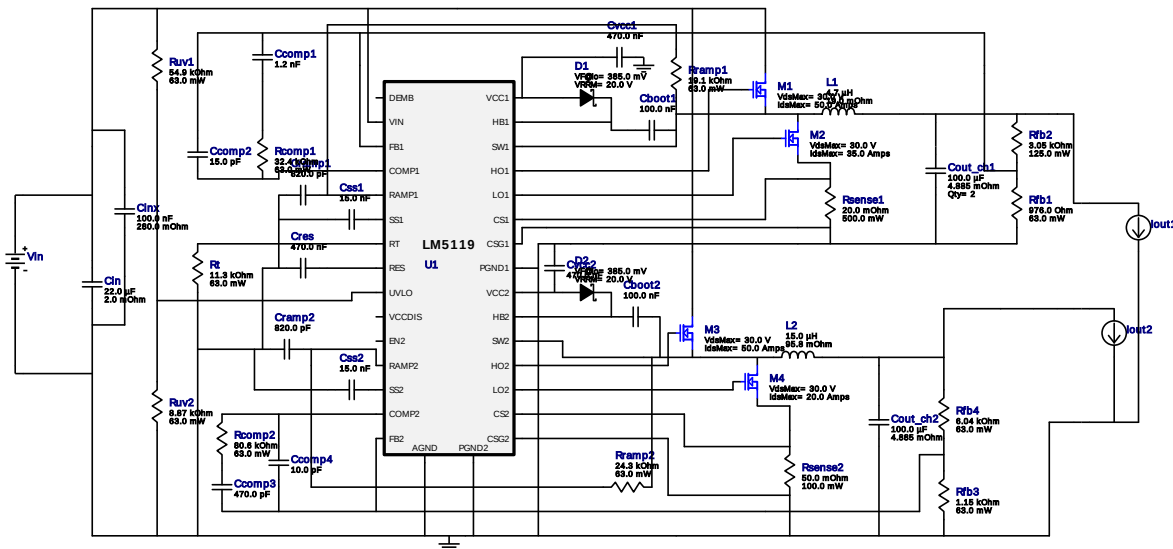


WEBENCH® Design Report

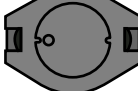
Design : 1831915/18 LM5119PSQ/NOPB
LM5119PSQ/NOPB 11.0V-13.0V to 5.00V @ 1.2A



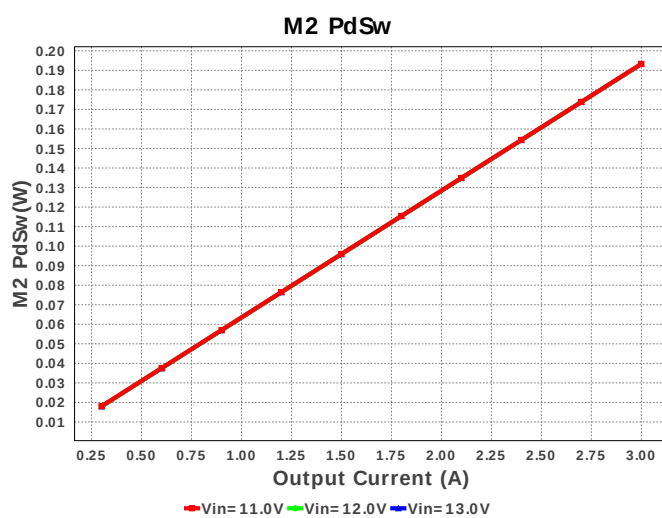
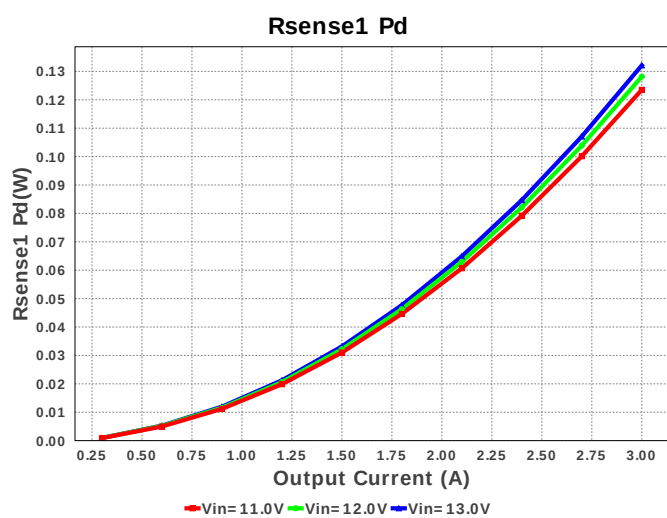
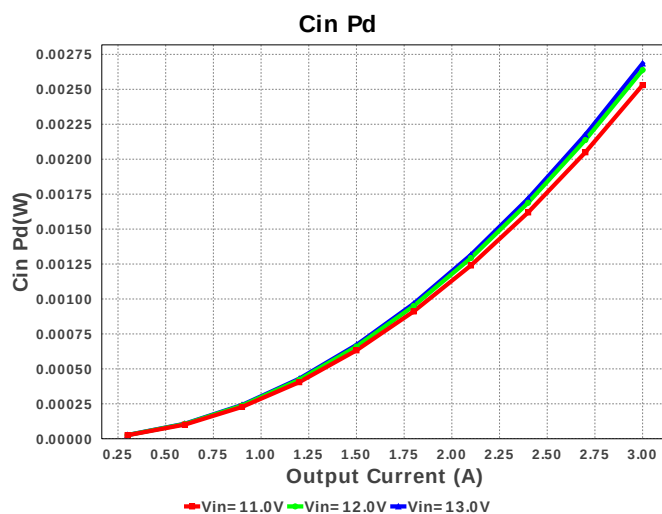
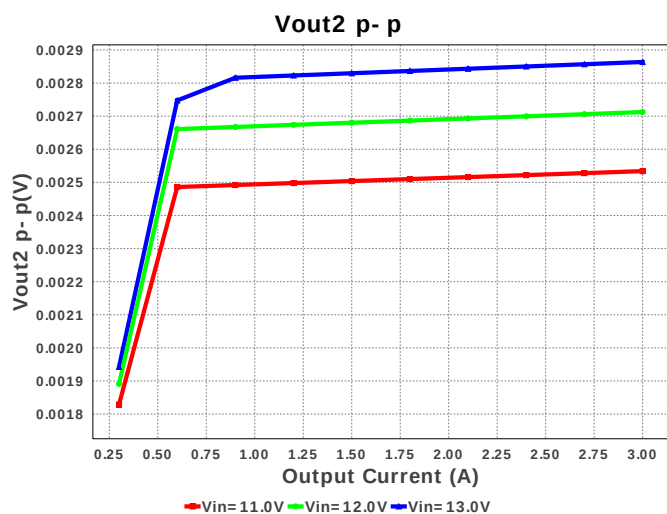
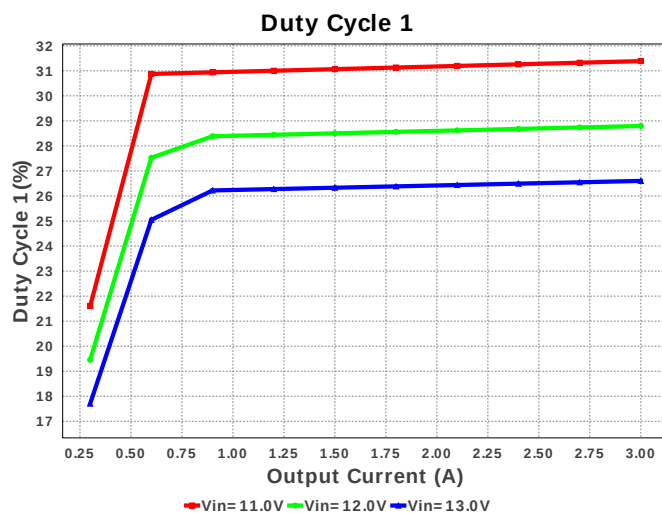
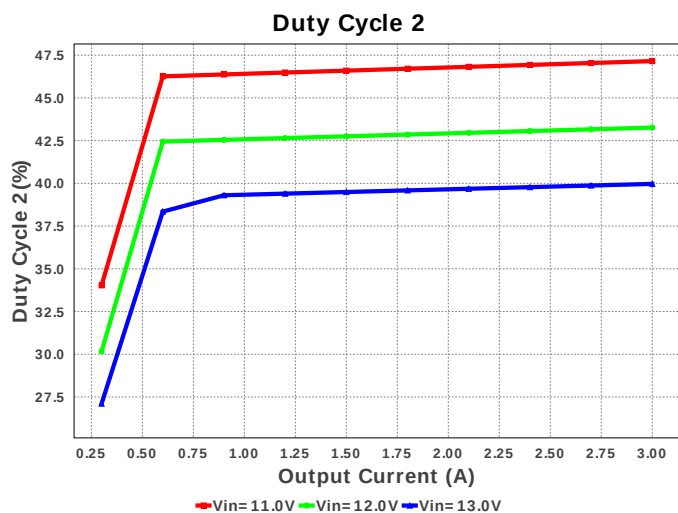
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

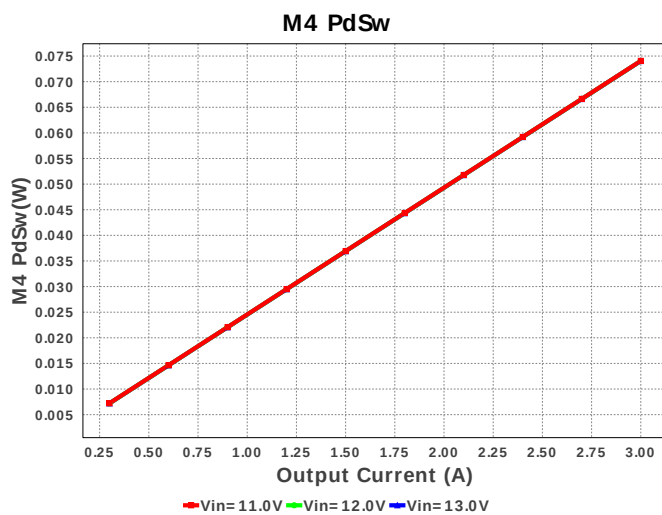
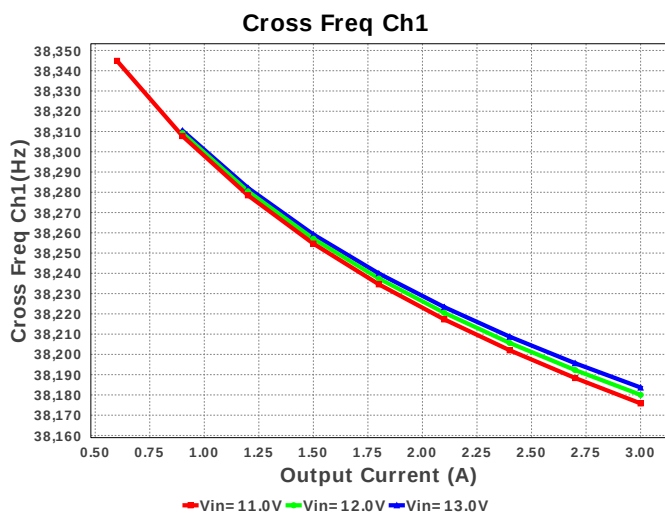
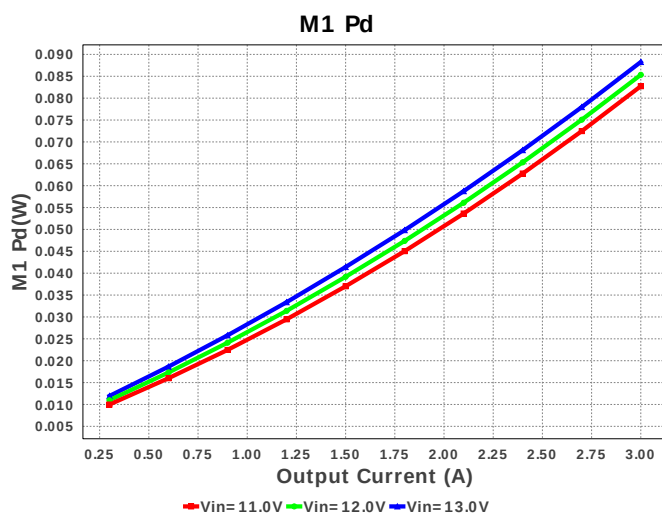
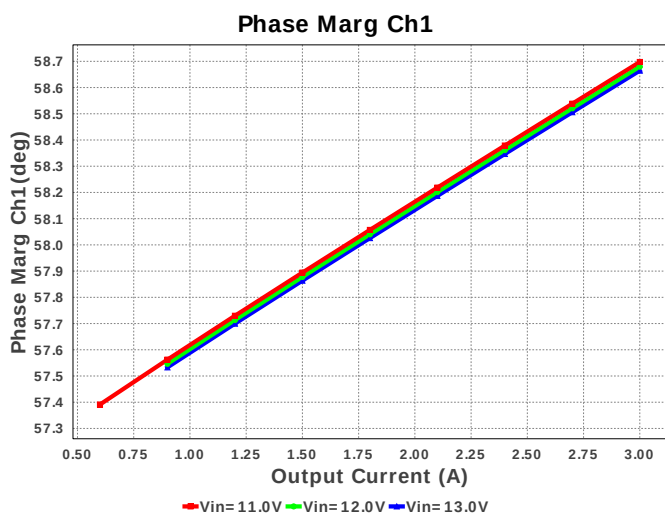
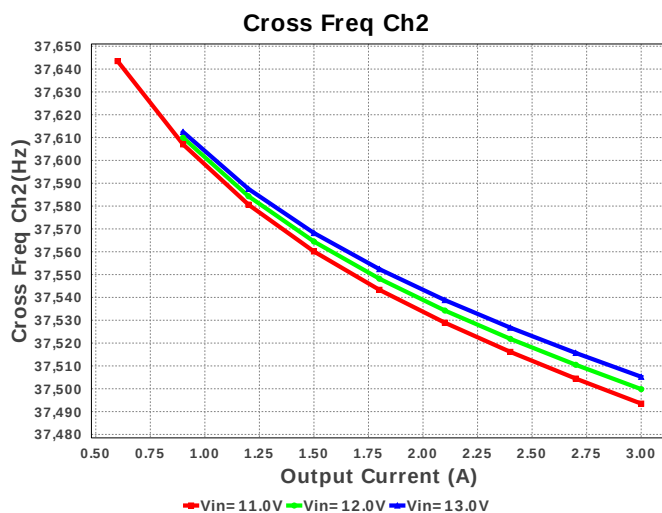
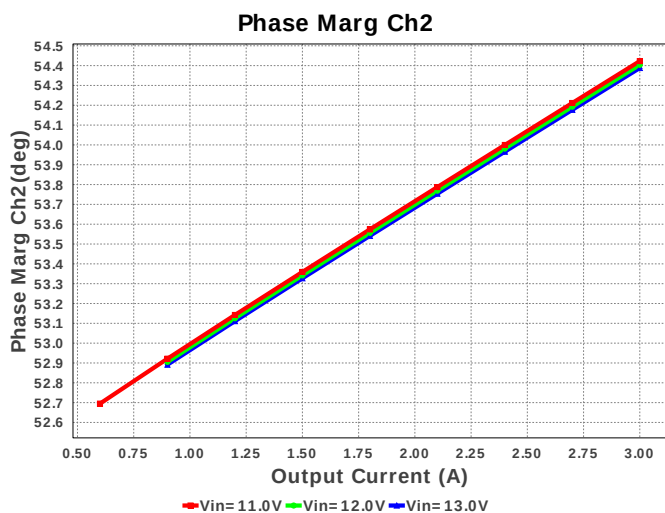
Electrical BOM

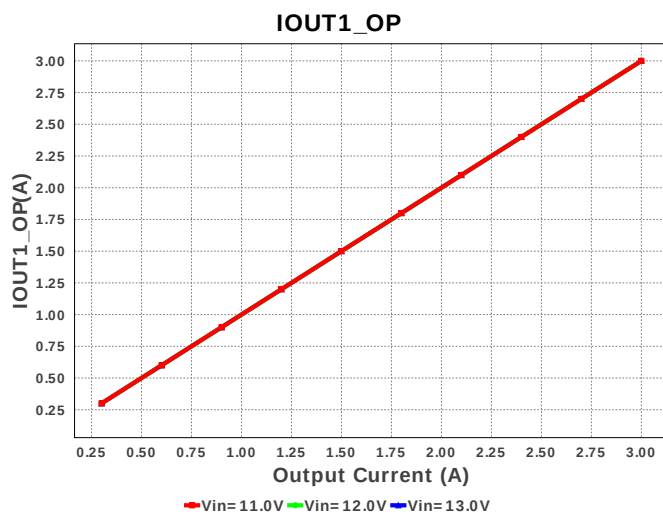
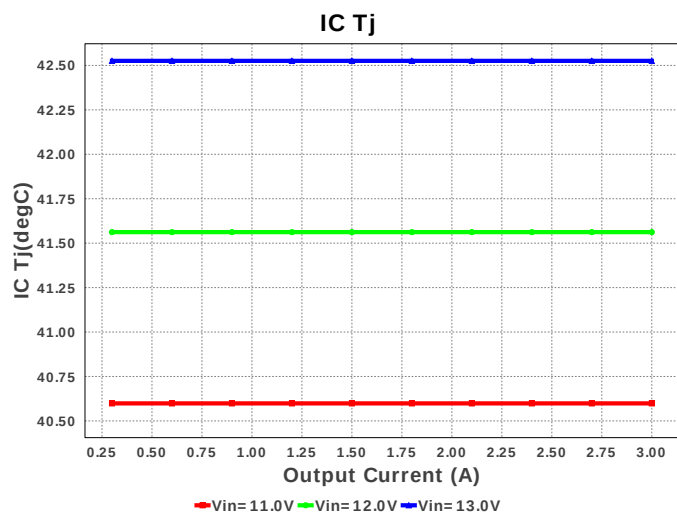
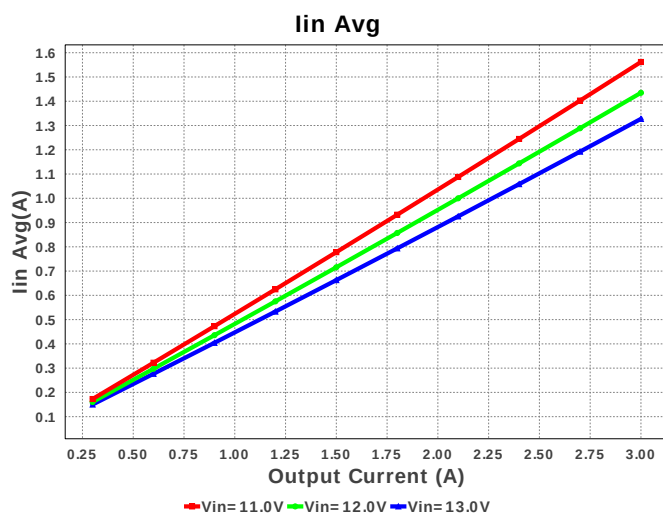
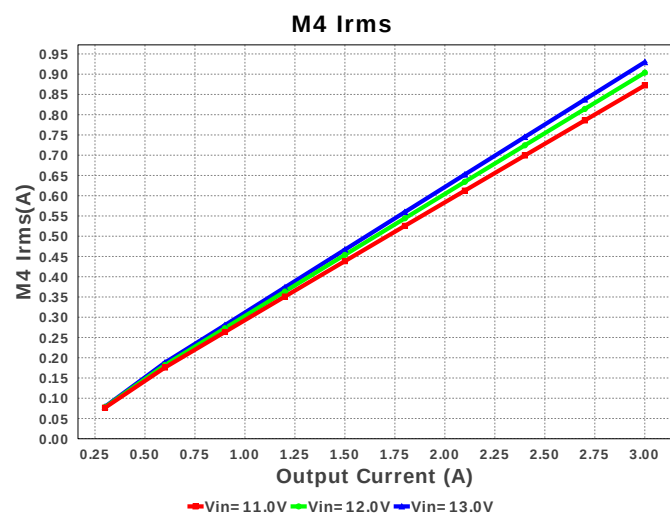
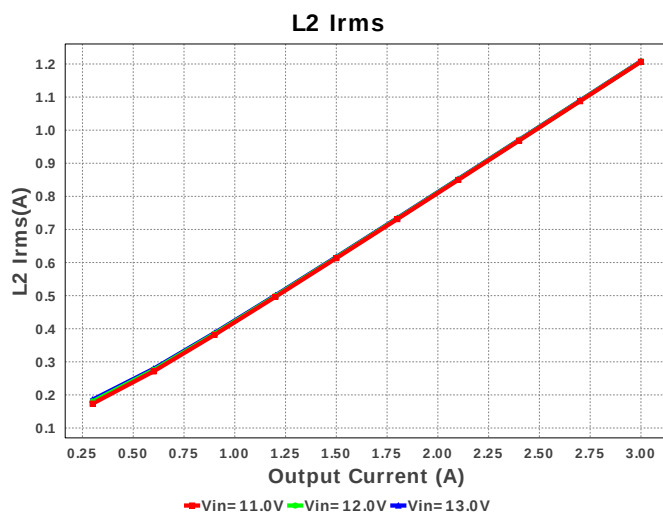
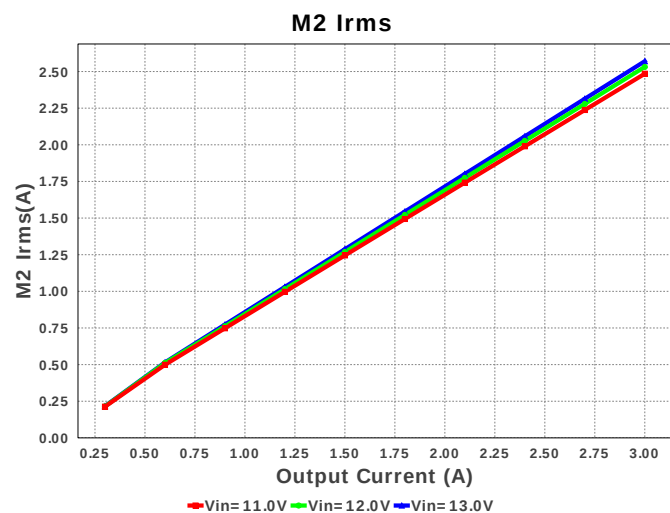
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1.	Cboot1	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
2.	Cboot2	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
3.	Ccomp1	Samsung Electro-Mechanics	CL21C122JBFNNWE Series= C0G/NP0	Cap= 1.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Ccomp2	Yageo America	CC0805JRNPO9BN150 Series= C0G/NP0	Cap= 15.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Ccomp3	Yageo America	CC0805KRX7R9BB471 Series= X7R	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Ccomp4	Kemet	C0805C100K5GACTU Series= C0G/NP0	Cap= 10.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
7.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	1	\$0.16	1210 15 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

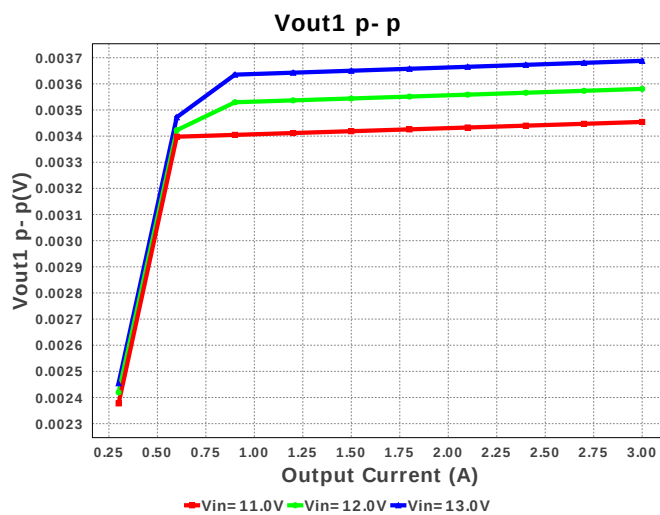
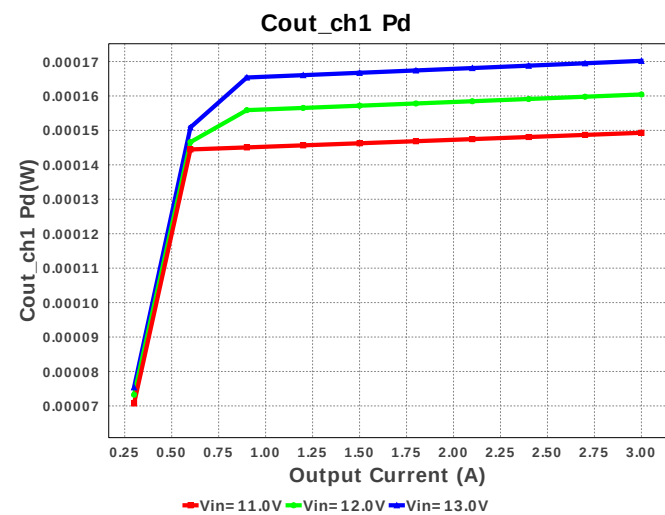
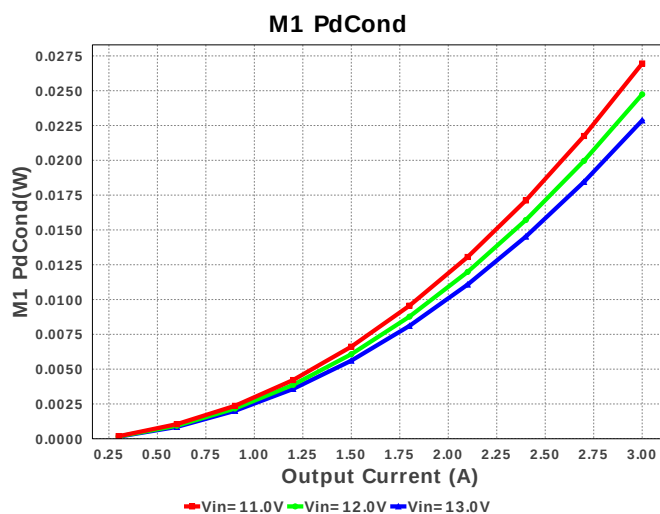
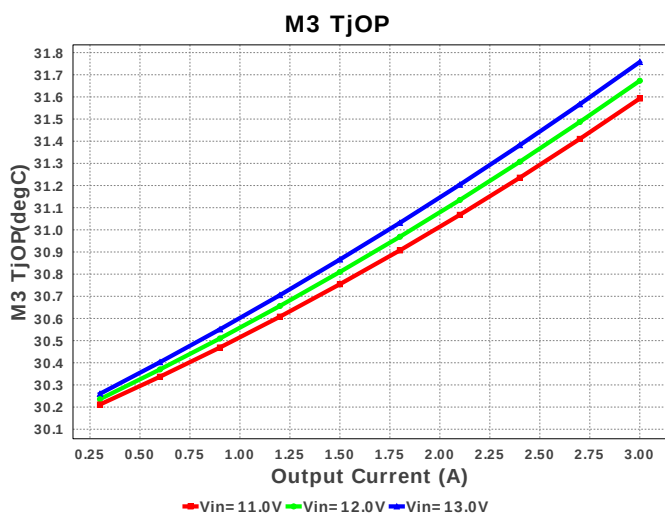
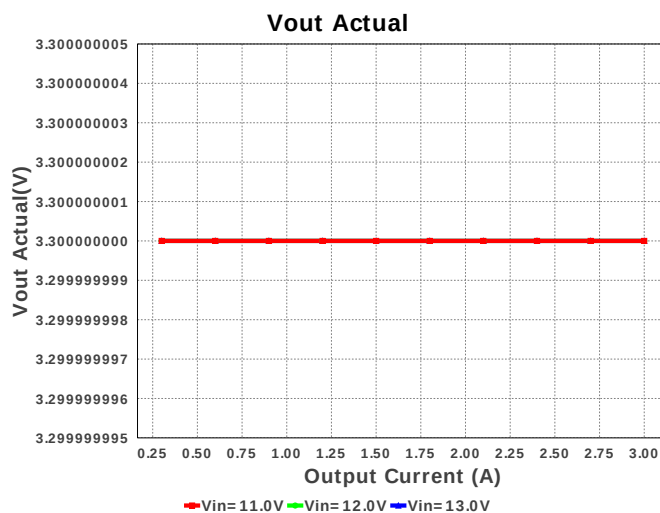
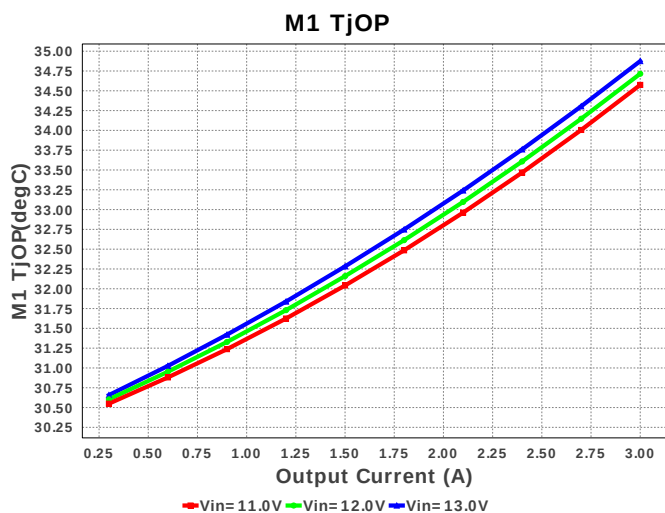
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9.	Cout_ch1	MuRata	GRM31CR60J107ME39L Series= X5R	Cap= 100.0 uF ESR= 4.885 mOhm VDC= 6.3 V IRMS= 4.4118 A	2	\$0.14	 1206_190 11 mm ²
10.	Cout_ch2	MuRata	GRM31CR60J107ME39L Series= X5R	Cap= 100.0 uF ESR= 4.885 mOhm VDC= 6.3 V IRMS= 4.4118 A	1	\$0.14	 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	SDR1005-4R7ML	L= 4.7 uH DCR= 19.0 mOhm	1	\$0.26	 SDR1005 176 mm ²
21.	L2	Bourns	SRN6045-150M	L= 15.0 uH DCR= 95.8 mOhm	1	\$0.16	 SRN6045 64 mm ²
22.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.28	 DQG0008A 18 mm ²
23.	M2	Texas Instruments	CSD17577Q3A	VdsMax= 30.0 V IdsMax= 35.0 Amps	1	\$0.24	 DNH0008A 18 mm ²
24.	M3	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.28	 DQG0008A 18 mm ²
25.	M4	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	\$0.19	 DNH0008A 18 mm ²
26.	Rcomp1	Vishay-Dale	CRCW040232K4FKED Series= CRCW..e3	Res= 32.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
27.	Rcomp2	Vishay-Dale	CRCW040280K6FKED Series= CRCW..e3	Res= 80.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

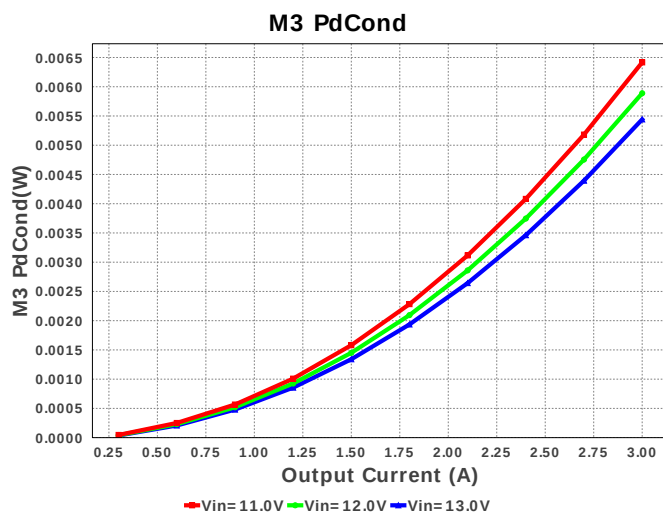
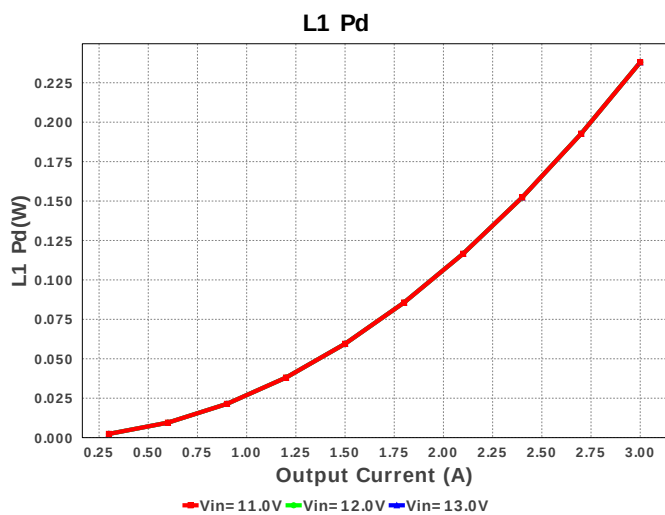
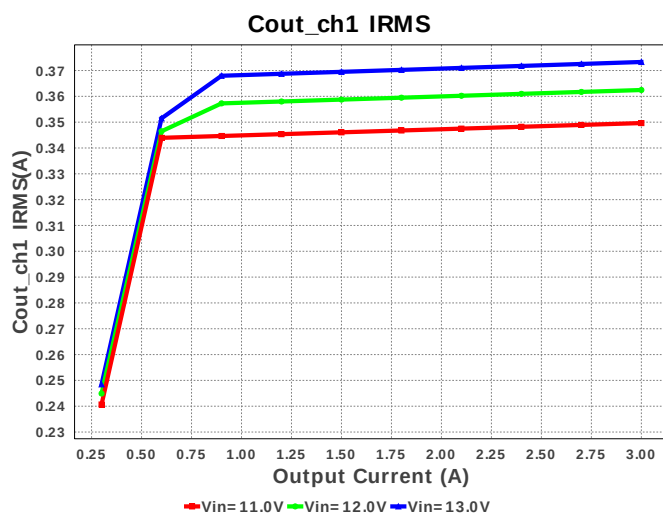
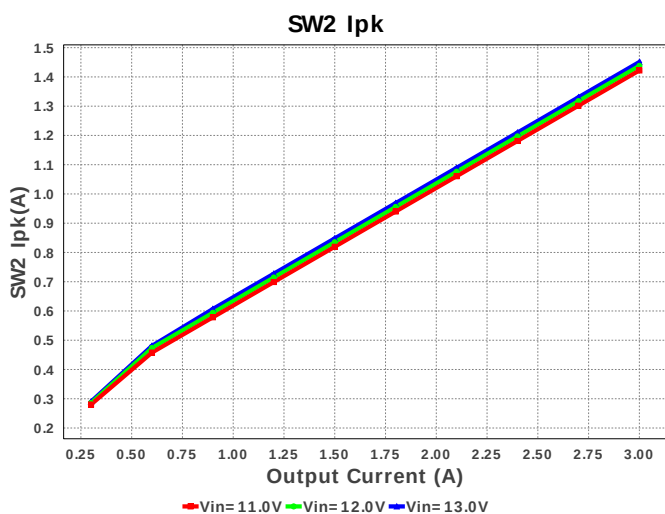
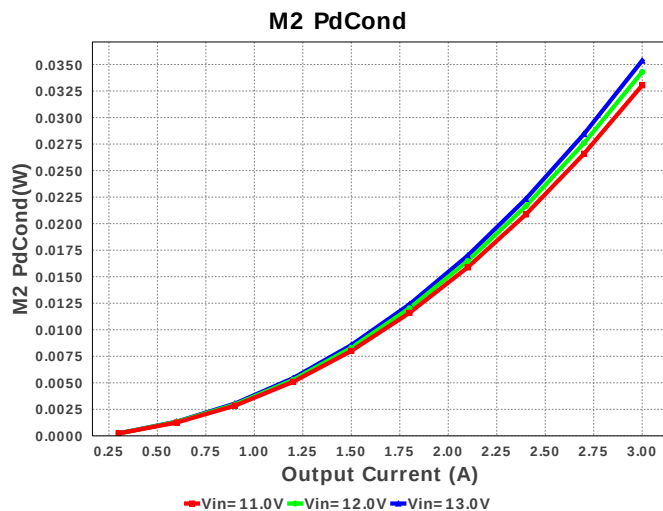
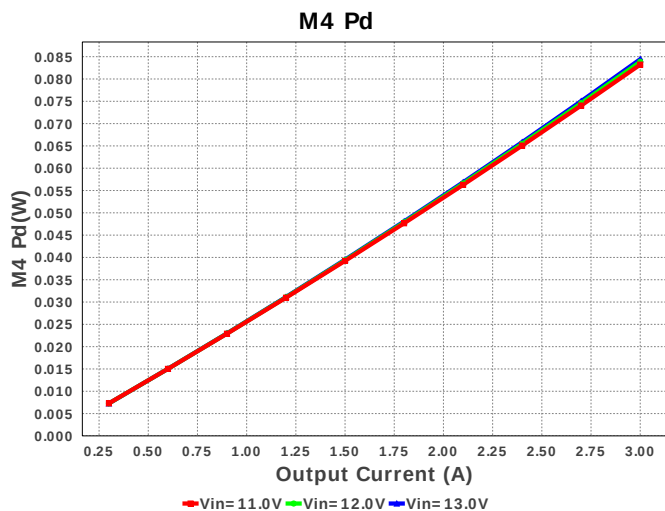
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	Rfb1	Vishay-Dale	CRCW0402976RFKED Series= CRCW..e3	Res= 976.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
29.	Rfb2	Yageo America	RT0805BRD073K05L Series= ?	Res= 3.05 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.04	 0805 7 mm ²
30.	Rfb3	Vishay-Dale	CRCW04021K15FKED Series= CRCW..e3	Res= 1.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
31.	Rfb4	Vishay-Dale	CRCW04026K04FKED Series= CRCW..e3	Res= 6.04 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
32.	Rramp1	Vishay-Dale	CRCW040219K1FKED Series= CRCW..e3	Res= 19.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
33.	Rramp2	Vishay-Dale	CRCW040224K3FKED Series= CRCW..e3	Res= 24.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
34.	Rsense1	Stackpole Electronics Inc	CSR1206FK20L0 Series= ?	Res= 20.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.10	 1206 11 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	CRCW04028K87FKED Series= CRCW..e3	Res= 8.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
39.	U1	Texas Instruments	LM5119PSQ/NOPB	Switcher	1	\$3.25	 SQA32A 49 mm ²

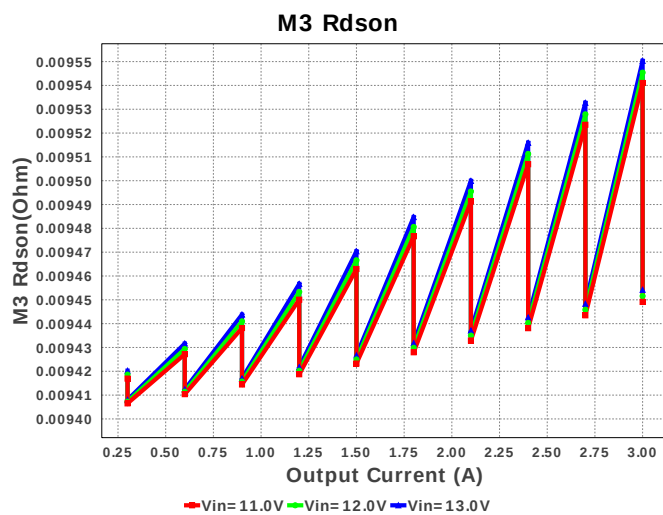
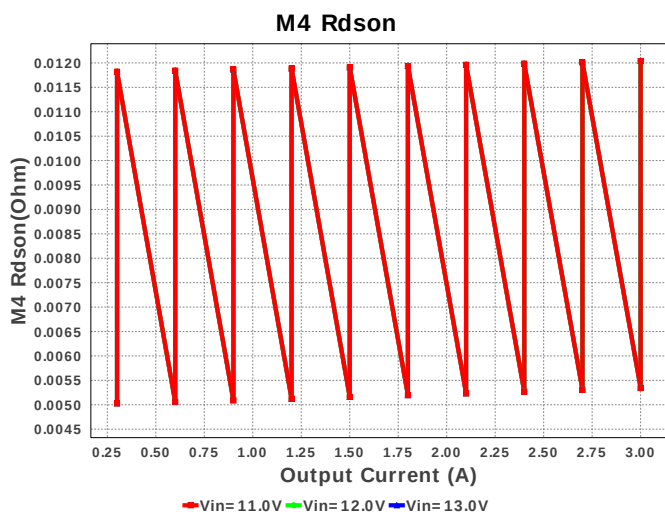
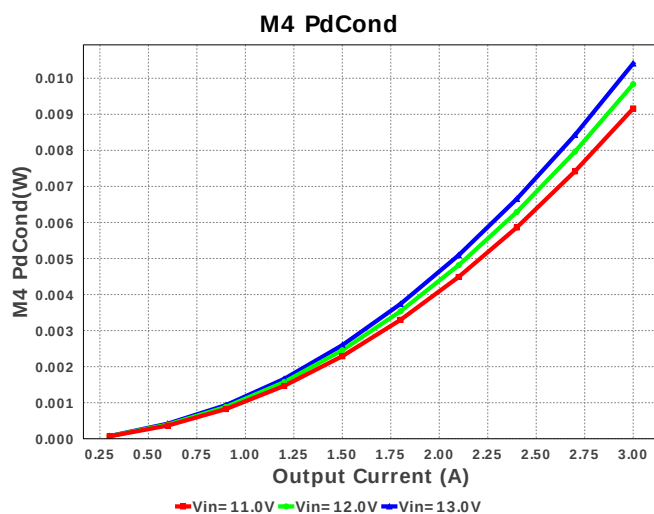
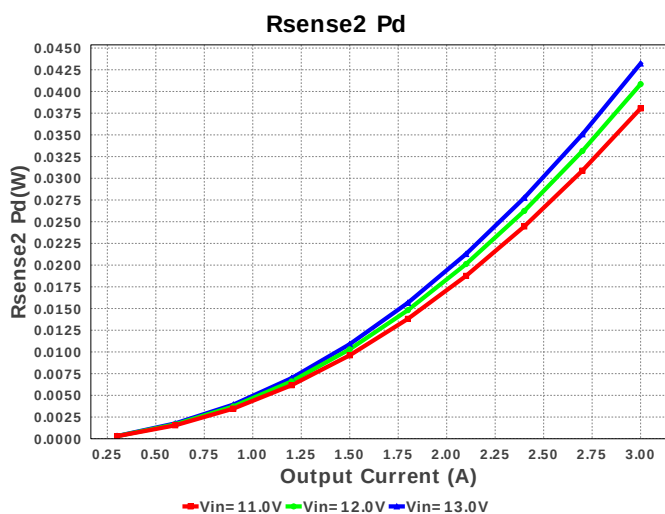
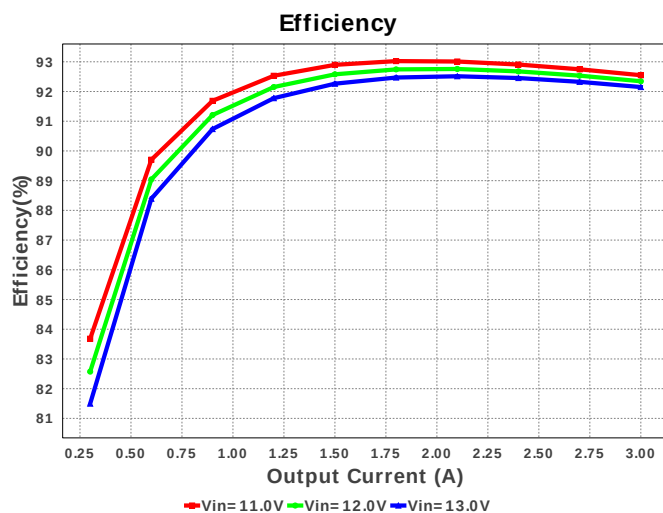
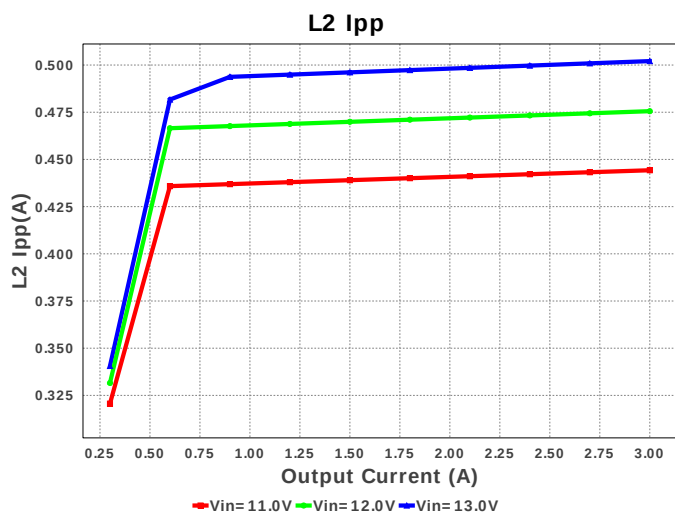


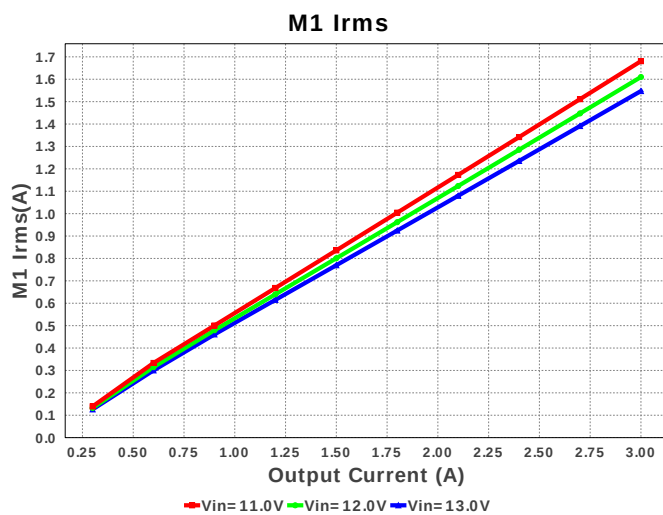
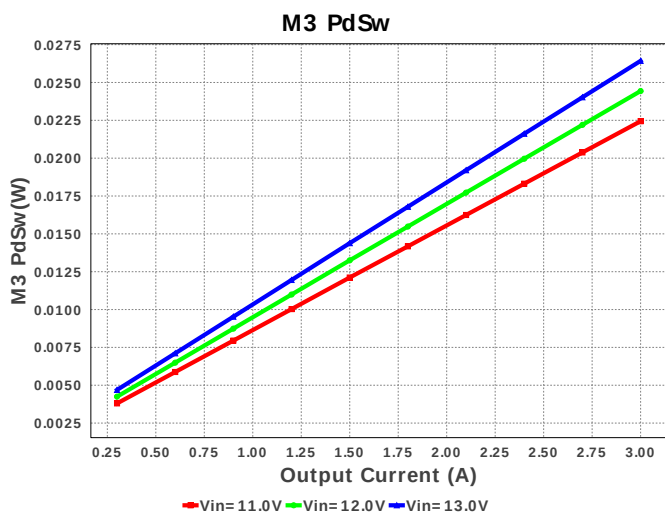
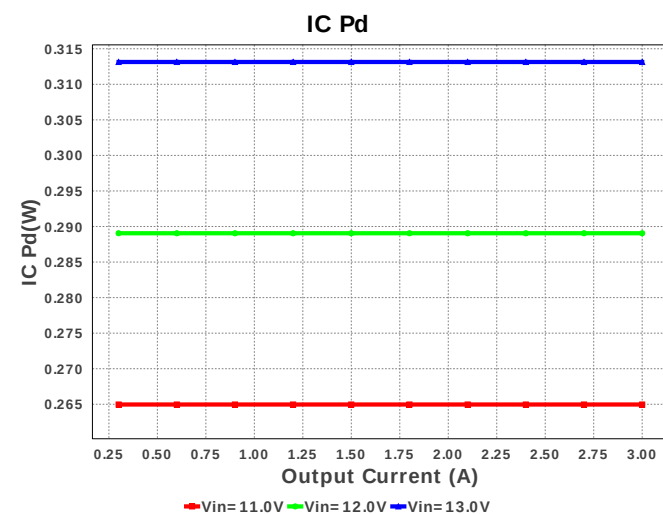
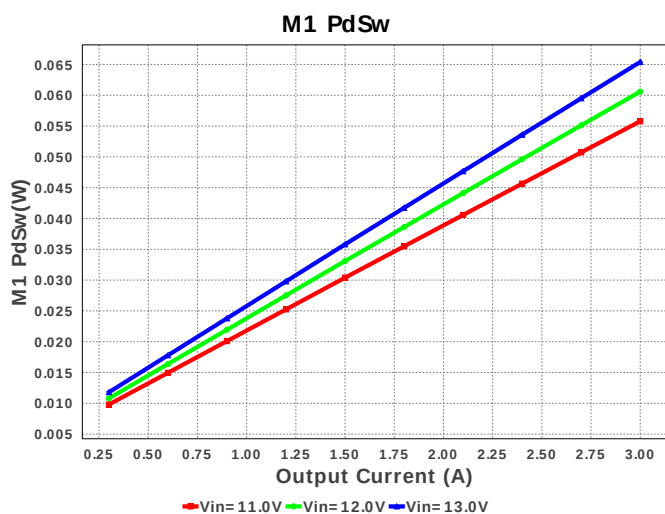
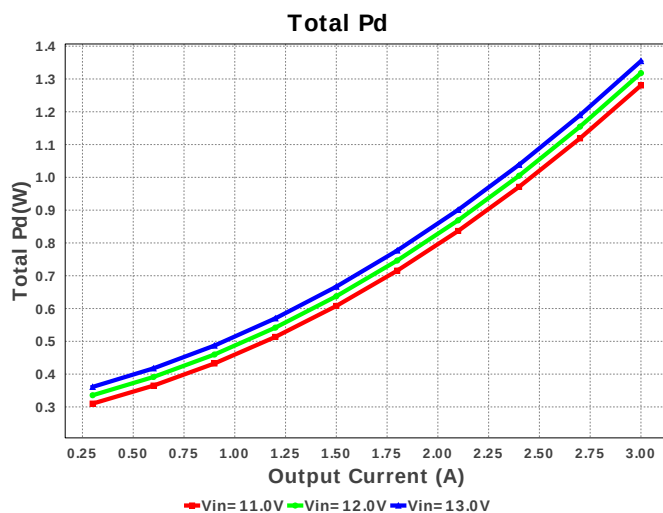
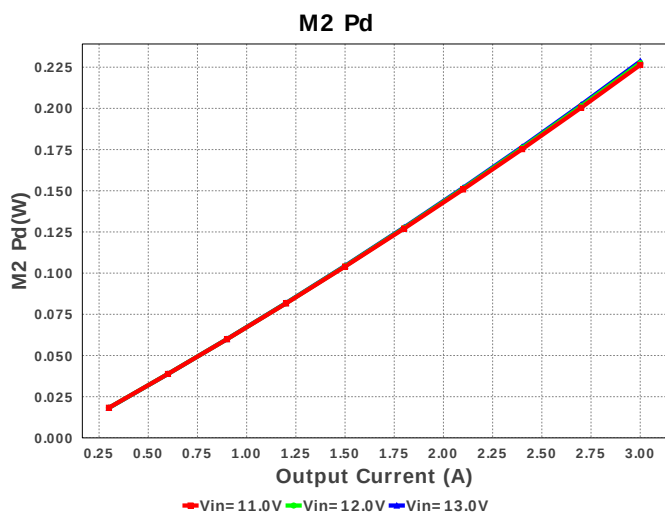


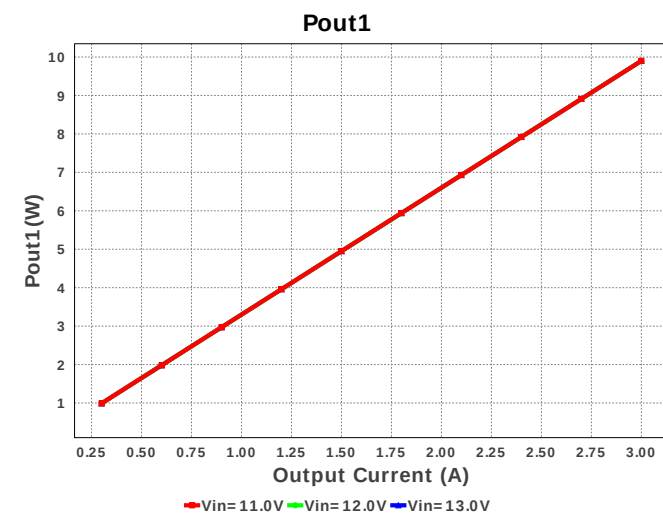
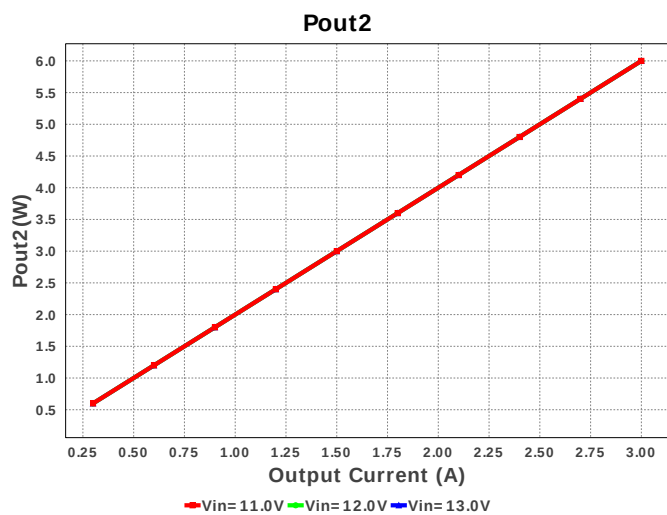
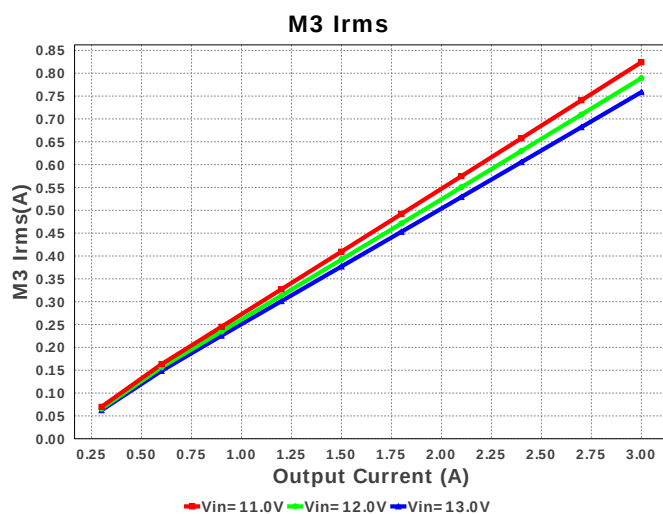
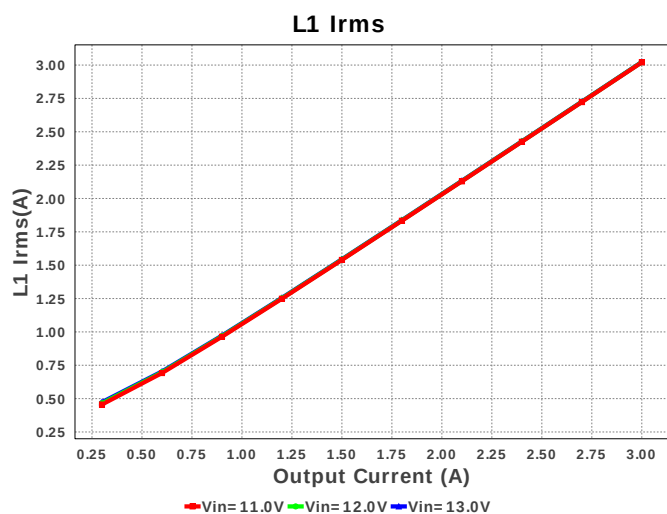
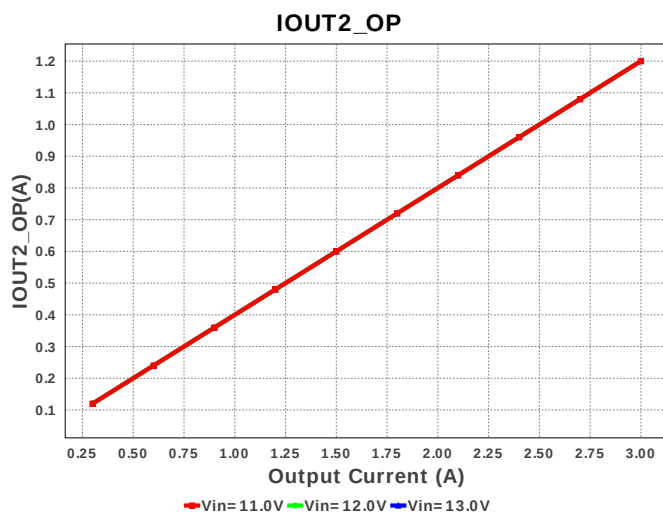
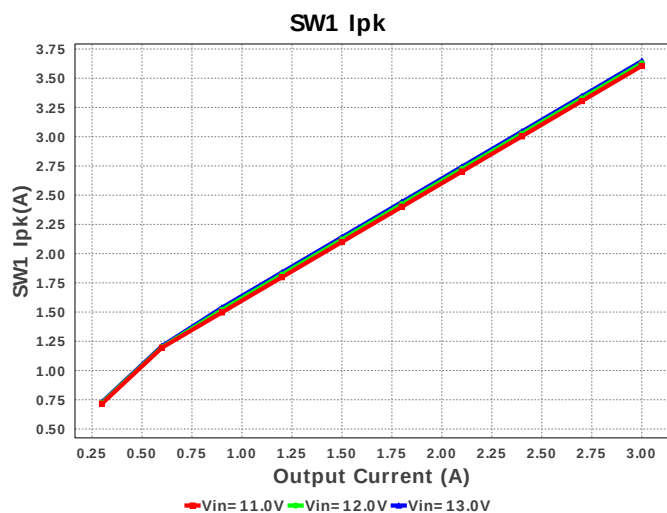


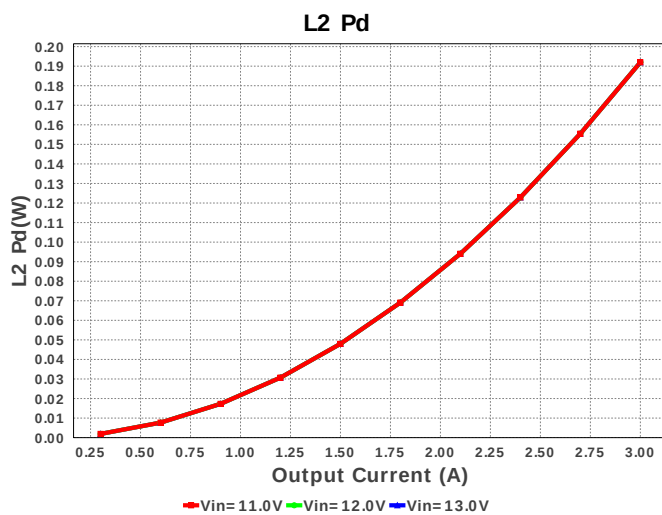
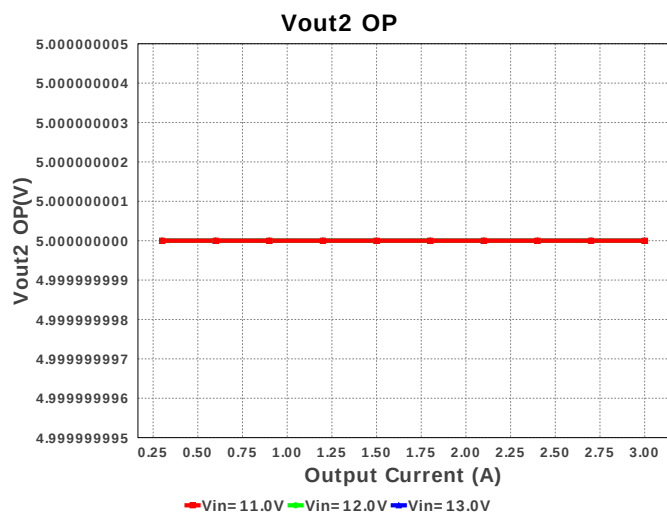
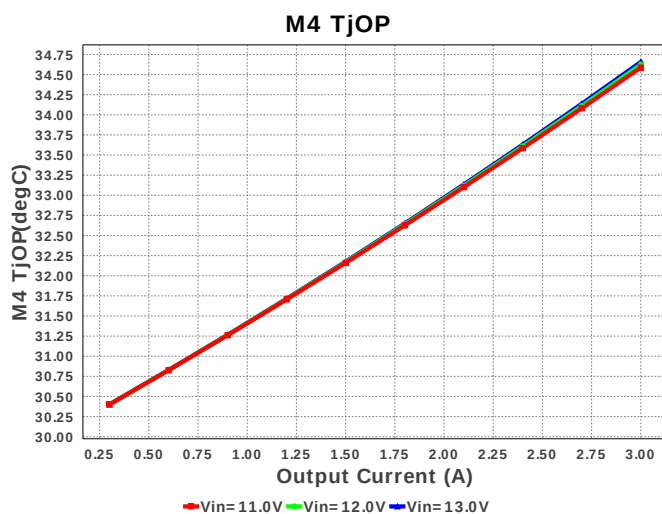
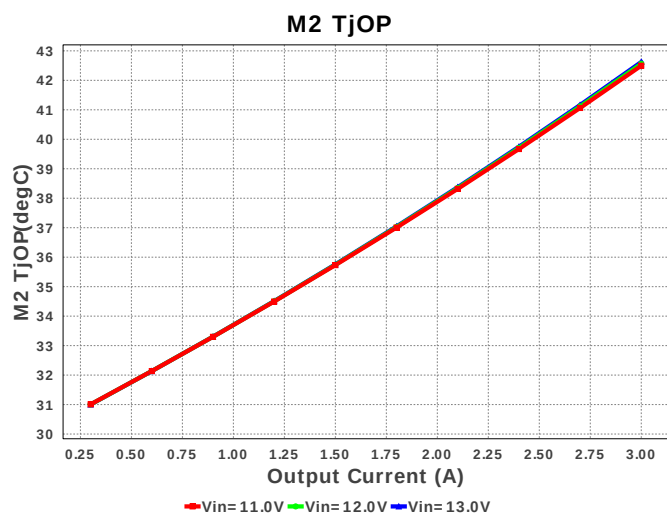
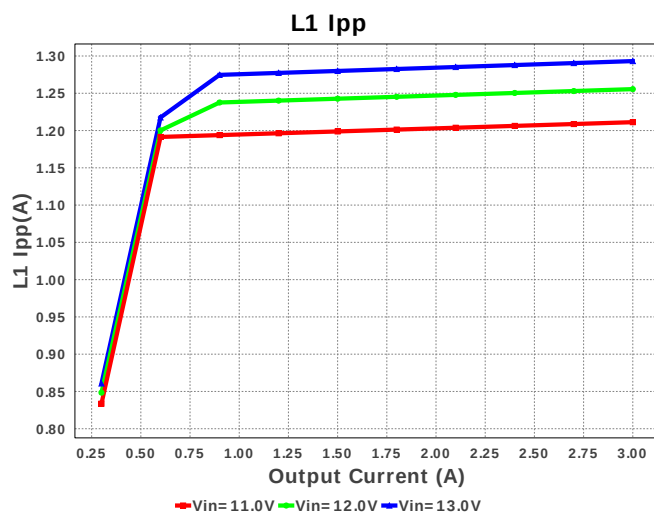
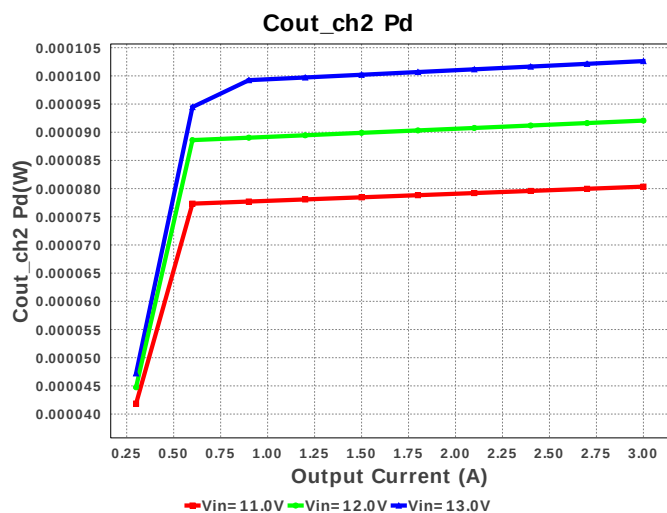


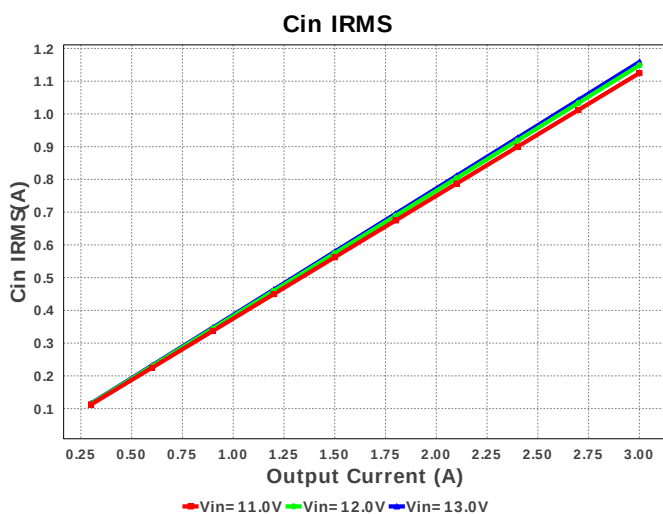
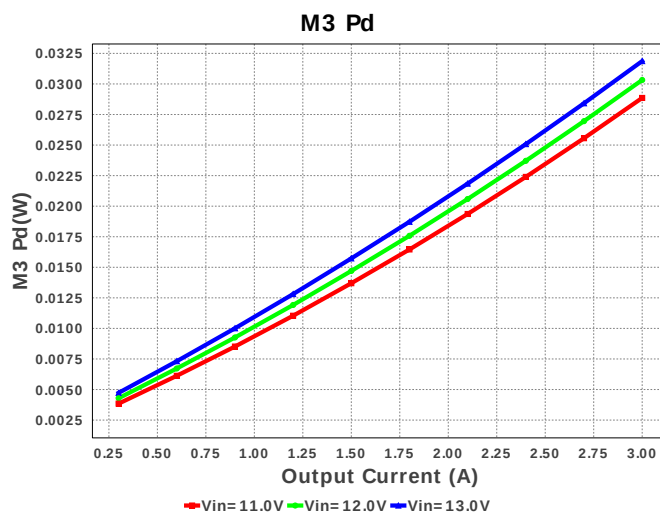
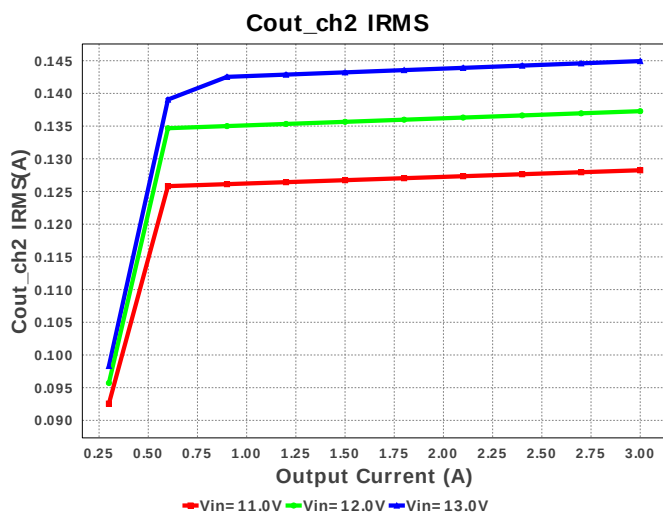












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.159 A	Current	Input capacitor RMS ripple current
2.	Cout_ch1 IRMS	373.304 mA	Current	Output Channel 1 Capacitor RMS ripple current
3.	Cout_ch2 IRMS	144.957 mA	Current	Output Channel 2 Capacitor RMS ripple current
4.	Iin Avg	1.327 A	Current	Average input current
5.	L1 Ipp	1.293 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	3.023 A	Current	Inductor ripple current
7.	L2 Ipp	502.144 mA	Current	Inductor 2 peak to peak current
8.	L2 Irms	1.209 A	Current	Inductor ripple current
9.	M1 Irms	1.547 A	Current	MOSFET RMS ripple current
10.	M2 Irms	2.57 A	Current	MOSFET RMS ripple current
11.	M3 Irms	758.774 mA	Current	MOSFET RMS ripple current
12.	M4 Irms	929.657 mA	Current	MOSFET RMS ripple current
13.	SW1 Ipk	3.647 A	Current	Peak switch current
14.	SW2 Ipk	1.451 A	Current	Peak switch current
15.	BOM Count	40	General	Total Design BOM count
16.	FootPrint	565.0 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	9.9 W	General	Channel 1 output Power
20.	Pout2	6.002 W	General	Channel 2 output Power
21.	Total BOM	\$5.83	General	Total BOM Cost
22.	ch1 Mode	CCM	General	Conduction Mode
23.	ch2 Mode	CCM	General	Conduction Mode
24.	M3 TjOP	31.757 degC	Op_Point	M3 MOSFET junction temperature
25.	M4 TjOP	34.656 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	26.602 %	Op_point	Duty cycle for Channel 1
28.	Duty Cycle 2	39.982 %	Op_point	Duty cycle for Channel 2
29.	Efficiency	92.151 %	Op_point	Steady state efficiency
30.	IC Tj	42.526 degC	Op_point	IC junction temperature
31.	IOUT1_OP	3.0 A	Op_point	Iout1 operating point

#	Name	Value	Category	Description
32.	IOUT2_OP	1.2 A	Op_point	Iout2 operating point
33.	M1 TjOP	34.874 degC	Op_point	M1 MOSFET junction temperature
34.	M2 TjOP	42.623 degC	Op_point	M2 MOSFET junction temperature
35.	VIN_OP	13.0 V	Op_point	Vin operating point
36.	Vout1 OP	3.3 V	Op_point	Operational Voltage 1
37.	Vout1 p-p	3.688 mV	Op_point	Peak-to-peak output1 ripple voltage
38.	Vout2 OP	5.002 V	Op_point	Operational Voltage 2
39.	Vout2 p-p	2.864 mV	Op_point	Peak-to-peak output2 ripple voltage
40.	Cin Pd	2.685 mW	Power	Input capacitor power dissipation
41.	Cout_ch1 Pd	170.188 µW	Power	Output channel 1 capacitor power dissipation
42.	Cout_ch2 Pd	102.646 µW	Power	Output channel 2 capacitor power dissipation
43.	IC Pd	313.14 mW	Power	IC power dissipation
44.	L1 Pd	237.95 mW	Power	Inductor power dissipation
45.	L2 Pd	191.963 mW	Power	Inductor power dissipation
46.	M1 Pd	88.254 mW	Power	M1 MOSFET total power dissipation
47.	M1 PdCond	22.865 mW	Power	M1 MOSFET conduction losses
48.	M1 PdSw	65.388 mW	Power	M1 MOSFET switching losses
49.	M2 Pd	228.576 mW	Power	M2 MOSFET total power dissipation
50.	M2 PdCond	35.364 mW	Power	M2 MOSFET conduction losses
51.	M2 PdSw	193.212 mW	Power	M2 MOSFET switching losses
52.	M3 Pd	31.866 mW	Power	M3 MOSFET total power dissipation
53.	M3 PdCond	5.443 mW	Power	M3 MOSFET conduction losses
54.	M3 PdSw	26.422 mW	Power	M3 MOSFET switching losses
55.	M3 Rdson	9.55 mOhm	Power	Drain-Source On-resistance
56.	M3 Rdson	9.454 mOhm	Power	Drain-Source On-resistance
57.	M4 Pd	84.436 mW	Power	M4 MOSFET total power dissipation
58.	M4 PdCond	10.407 mW	Power	M4 MOSFET conduction losses
59.	M4 PdSw	74.029 mW	Power	M4 MOSFET switching losses
60.	M4 Rdson	5.353 mOhm	Power	Drain-Source On-resistance
61.	M4 Rdson	12.042 mOhm	Power	Drain-Source On-resistance
62.	Rsense1 Pd	132.116 mW	Power	Current Limit Sense Resistor Power Dissipation
63.	Rsense2 Pd	43.213 mW	Power	Current Limit Sense Resistor Power Dissipation
64.	Total Pd	1.354 W	Power	Total Power Dissipation
65.	Cross Freq Ch1	38.185 kHz		Bode plot crossover frequency
66.	Cross Freq Ch2	37.506 kHz		Bode plot crossover frequency
67.	Phase Marg Ch1	58.659 deg		Bode Plot Phase Margin
68.	Phase Marg Ch2	54.384 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	3.0	Maximum Output Current
2.	Iout1	3.0	Output Current #1
3.	Iout2	1.2	Output Current #2
4.	VinMax	13.0	Maximum input voltage
5.	VinMin	11.0	Minimum input voltage
6.	VinTyp	12.0	Typical input voltage
7.	Vout	3.3	Output Voltage
8.	Vout1	3.3	Output Voltage #1
9.	Vout2	5.0	Output Voltage #2
10.	base_pn	LM5119	Texas Instruments Base Part Number
11.	source	DC	Input Source Type
12.	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. LM5119 Product Folder : <http://www.ti.com/product/LM5119> : contains the data sheet and other resources.

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