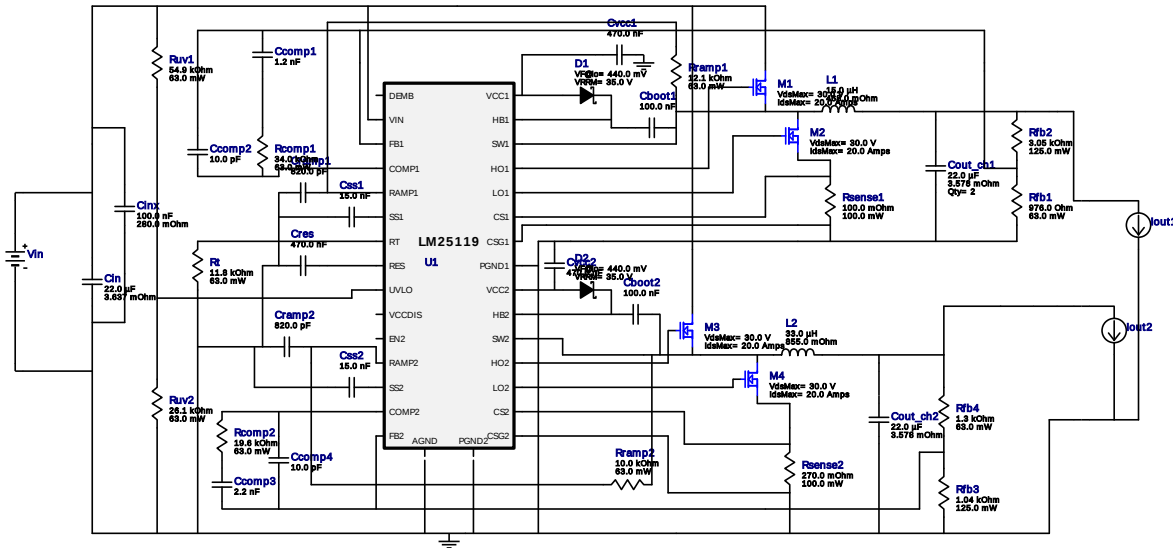


WEBENCH® Design Report

Design : 3496425/108 LM25119PSQ/NOPB
LM25119PSQ/NOPB 4.8V-5.2V to 1.80V @ 0.2A



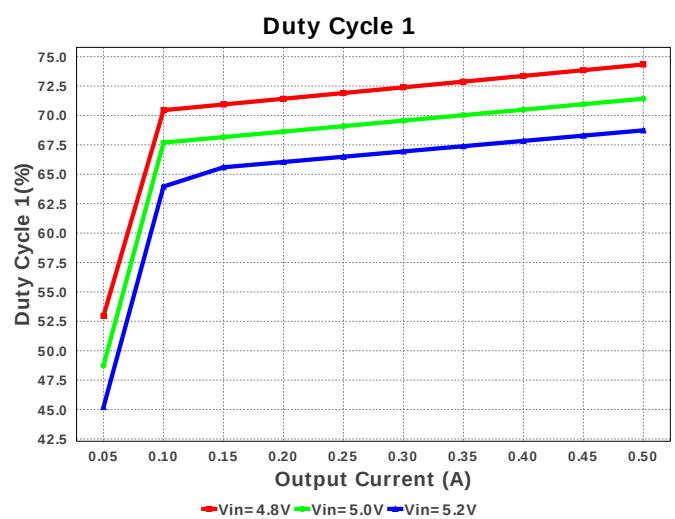
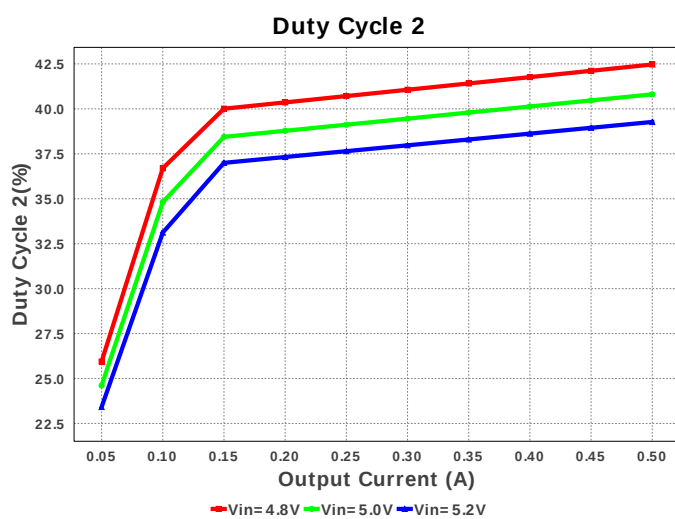
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

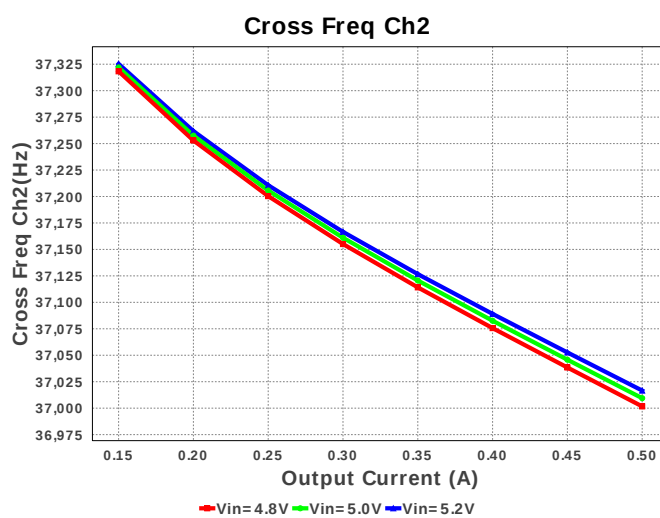
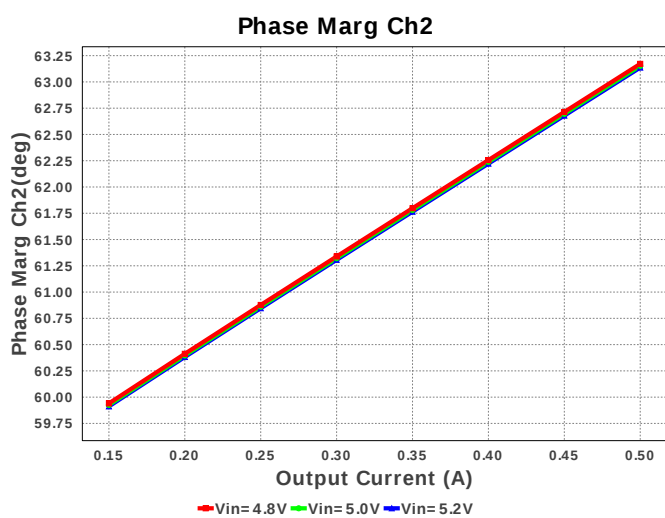
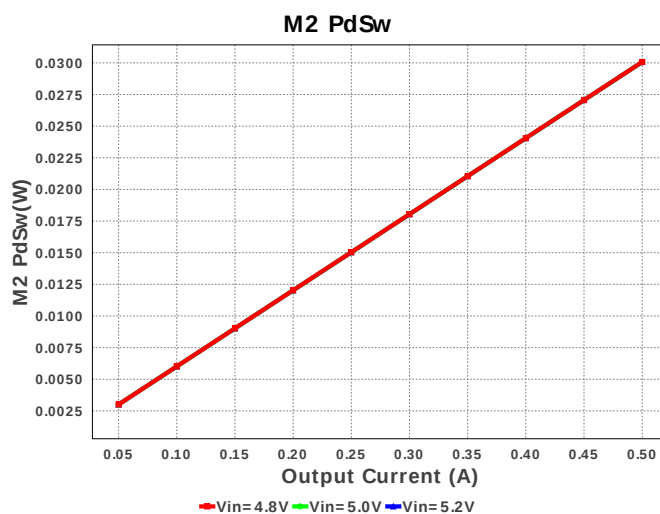
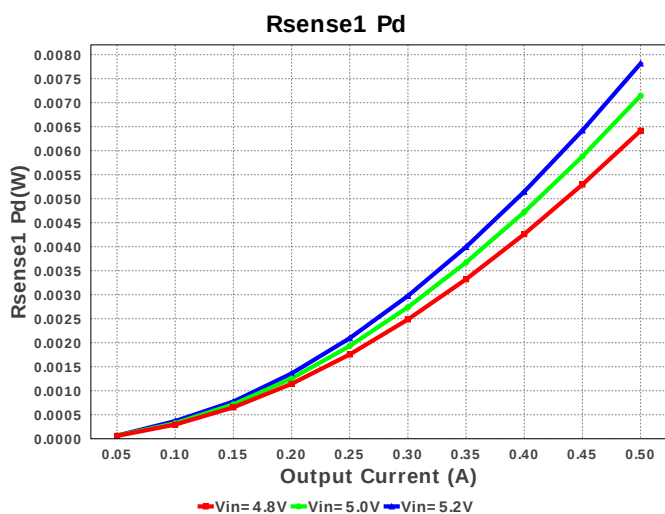
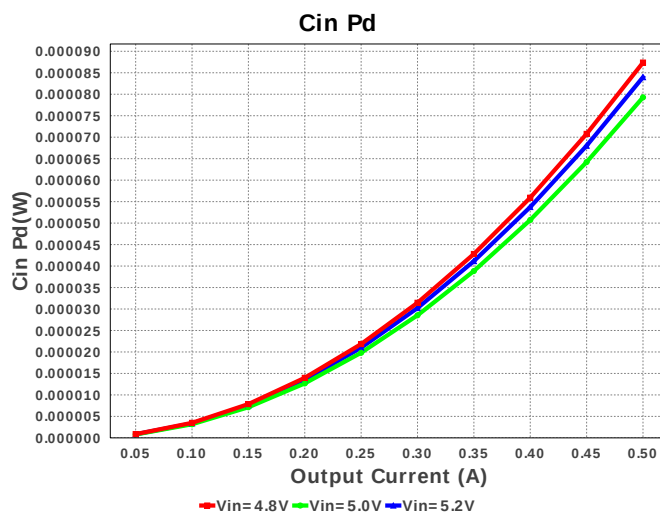
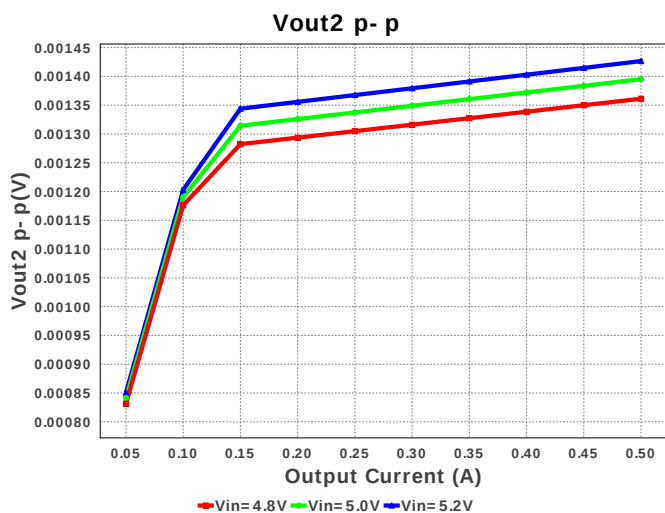
Electrical BOM

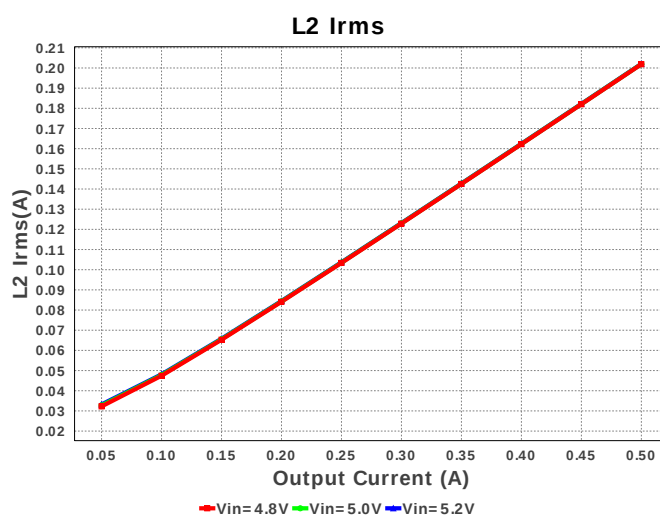
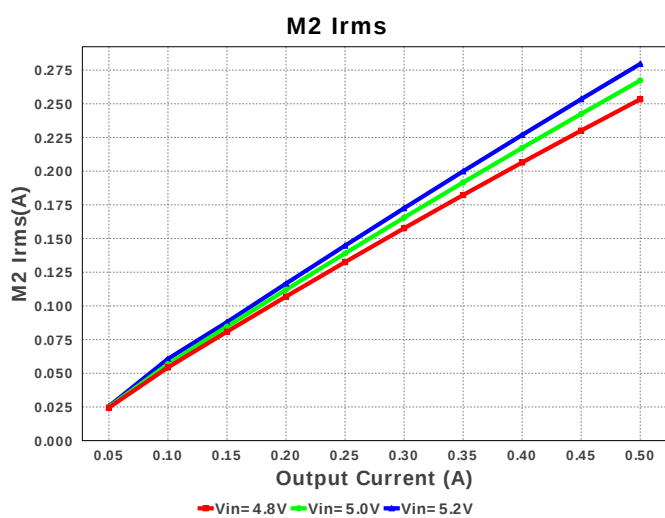
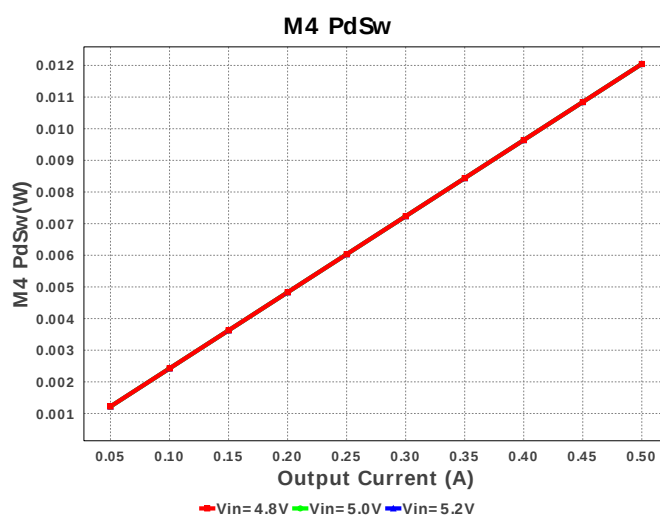
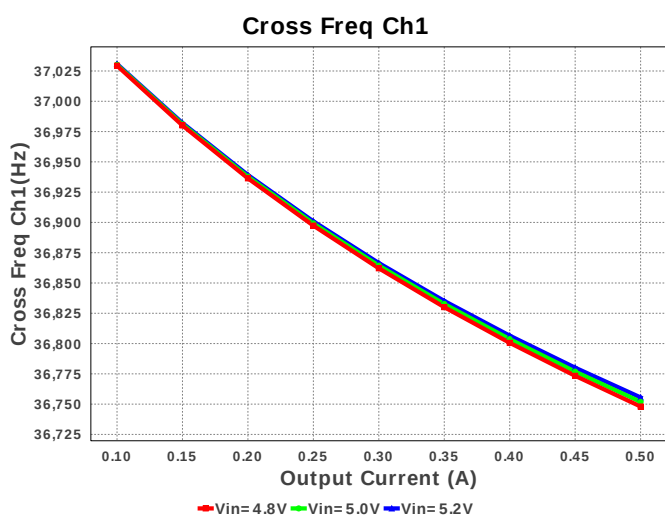
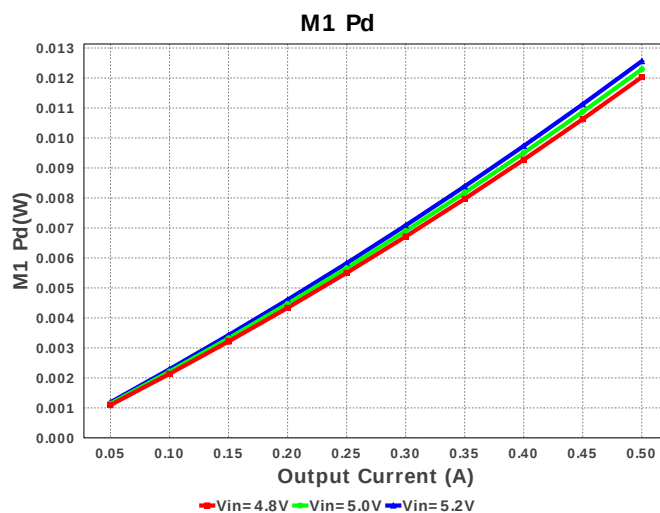
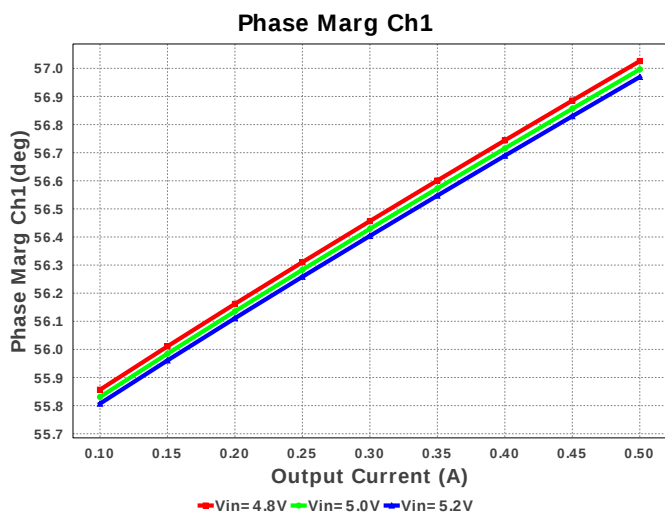
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1.	Cboot1	MuRata	GRM155R60J104KA01D Series= X5R	Cap= 100.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
2.	Cboot2	MuRata	GRM155R60J104KA01D Series= X5R	Cap= 100.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
3.	Ccomp1	Samsung Electro-Mechanics	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	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	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF 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	GRM31CR61A226KE19L Series= X5R	Cap= 22.0 uF ESR= 3.637 mOhm VDC= 10.0 V IRMS= 3.56456 A	1	\$0.07	1206_190 11 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

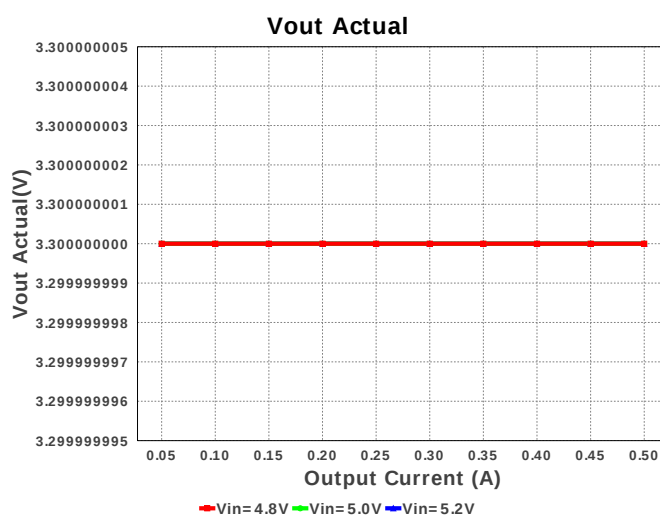
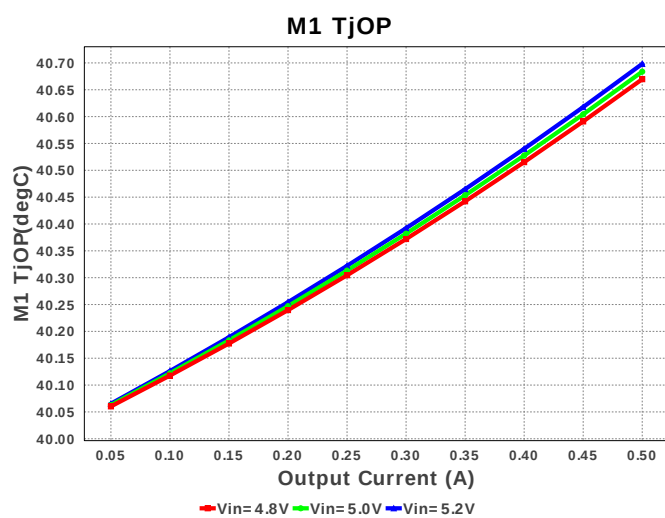
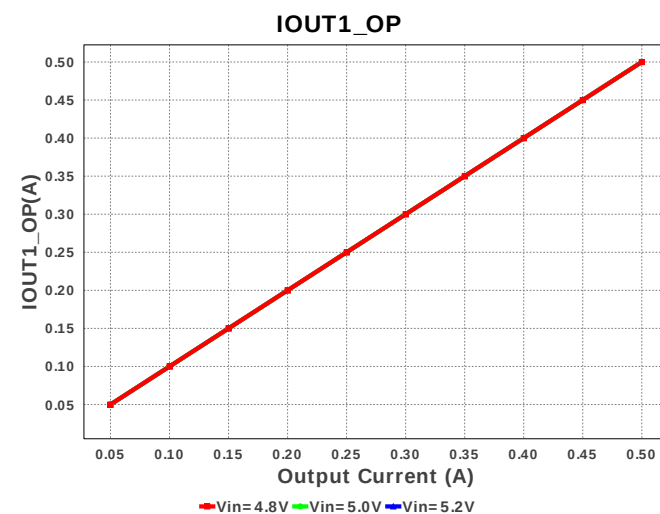
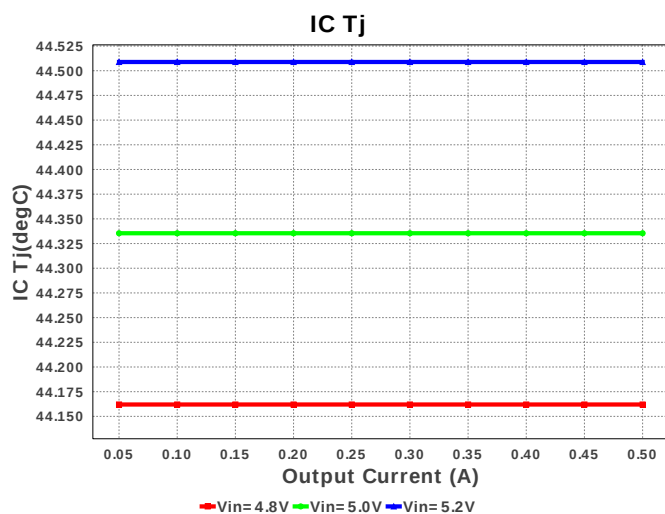
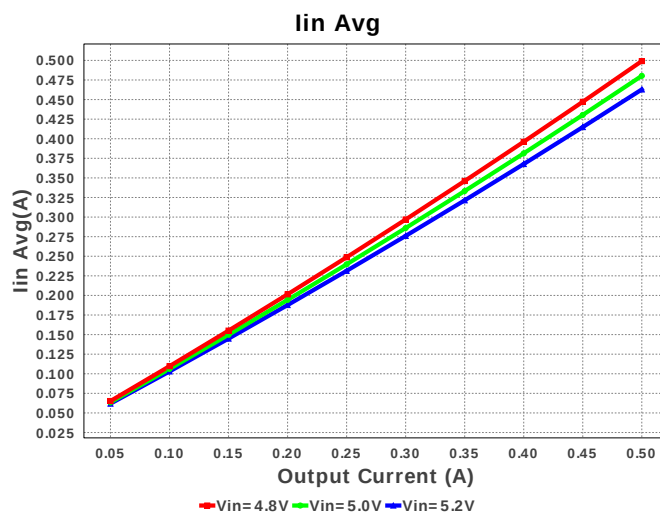
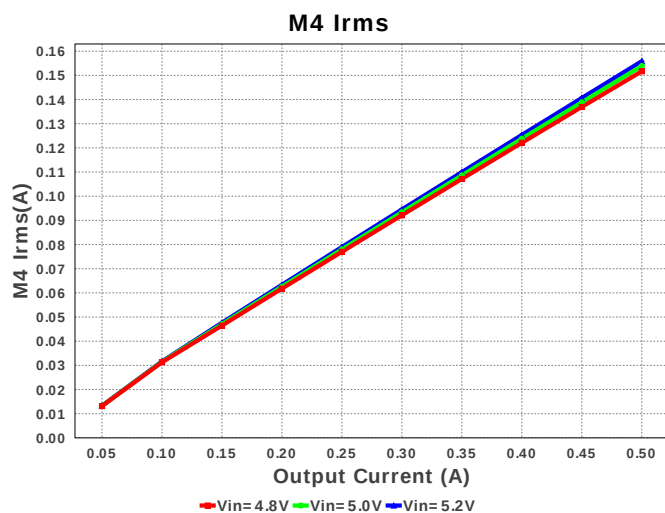
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9.	Cout_ch1	MuRata	GRM21BC80G226ME39L Series= X6S	Cap= 22.0 uF ESR= 3.578 mOhm VDC= 4.0 V IRMS= 3.29633 A	2	\$0.04	 0805 7 mm ²
10.	Cout_ch2	MuRata	GRM21BC80G226ME39L Series= X6S	Cap= 22.0 uF ESR= 3.578 mOhm VDC= 4.0 V IRMS= 3.29633 A	1	\$0.04	 0805 7 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	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
17.	Cvcc2	MuRata	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
18.	D1	Bourns	CD0603-B0130L	VF@Io= 440.0 mV VRRM= 35.0 V	1	\$0.09	 Diode_0603 5 mm ²
19.	D2	Bourns	CD0603-B0130L	VF@Io= 440.0 mV VRRM= 35.0 V	1	\$0.09	 Diode_0603 5 mm ²
20.	L1	Coilcraft	ME3220-153KLB	L= 15.0 uH DCR= 468.0 mOhm	1	\$0.23	 ME3220 16 mm ²
21.	L2	Coilcraft	XFL3012-333MEB	L= 33.0 uH DCR= 855.0 mOhm	1	\$0.43	 XFL3012 16 mm ²
22.	M1	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	\$0.19	 DNH0008A 18 mm ²
23.	M2	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	\$0.19	 DNH0008A 18 mm ²
24.	M3	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	\$0.19	 DNH0008A 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	CRCW040234K0FKED Series= CRCW..e3	Res= 34.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
27.	Rcomp2	Vishay-Dale	CRCW040219K6FKED Series= CRCW..e3	Res= 19.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
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

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
30.	Rfb3	Yageo America	RT0805BRD071K04L Series= RT0805	Res= 1.04 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.05	 0805 7 mm ²
31.	Rfb4	Vishay-Dale	CRCW04021K30FKED Series= CRCW..e3	Res= 1.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
32.	Rramp1	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
33.	Rramp2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
34.	Rsense1	Panasonic	ERJ-3RSFR10V Series= ERJ-3R	Res= 100.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.03	 0603 5 mm ²
35.	Rsense2	Panasonic	ERJ-3RQFR27V Series= ERJ-3R	Res= 270.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.02	 0603 5 mm ²
36.	Rt	Vishay-Dale	CRCW040211K8FKED Series= CRCW..e3	Res= 11.8 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	CRCW040226K1FKED Series= CRCW..e3	Res= 26.1 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

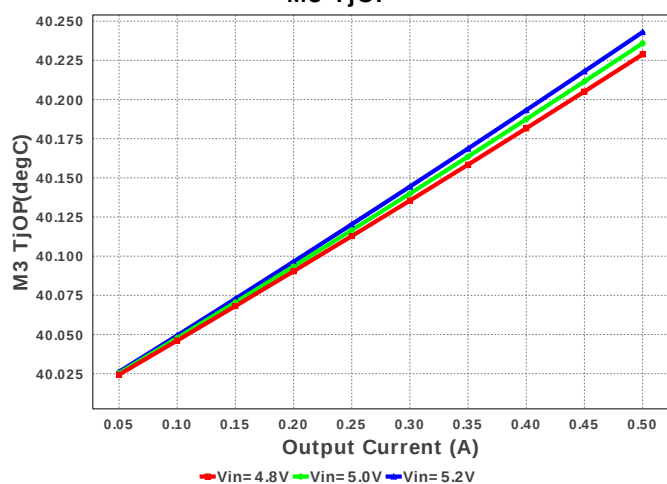




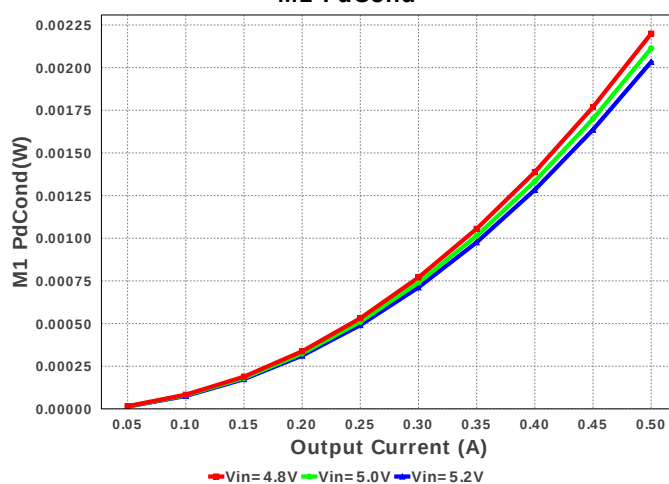




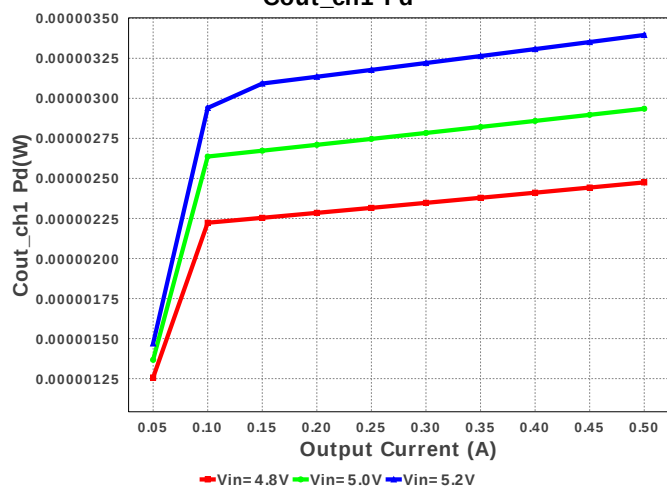
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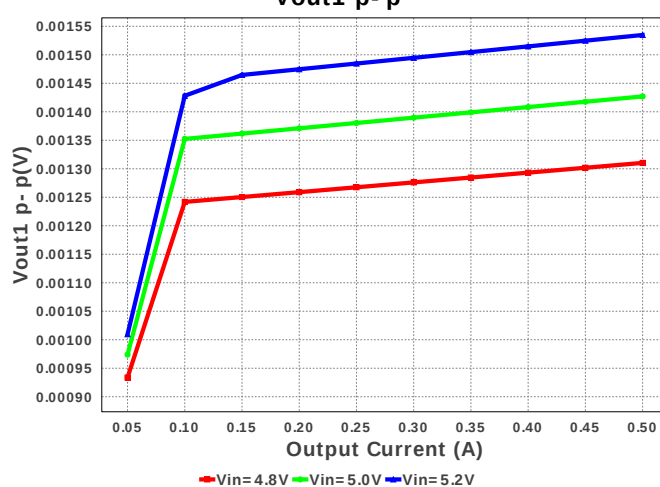
M1 PdCond



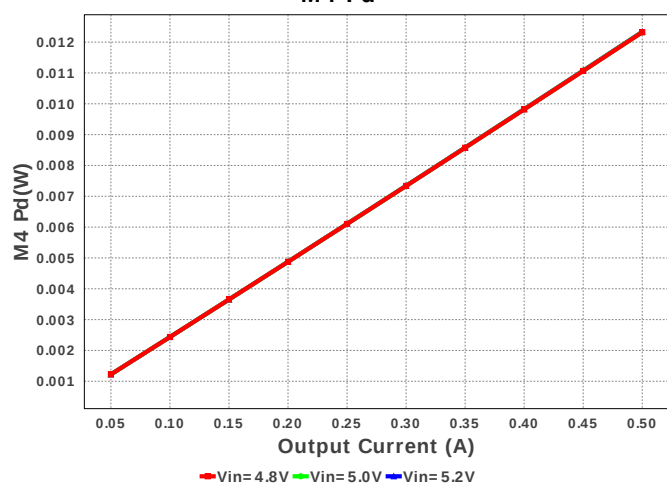
Cout_ch1 Pd



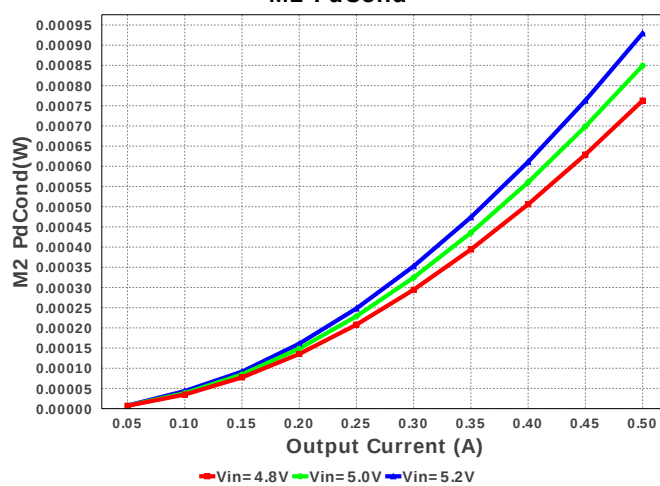
Vout1 p- p

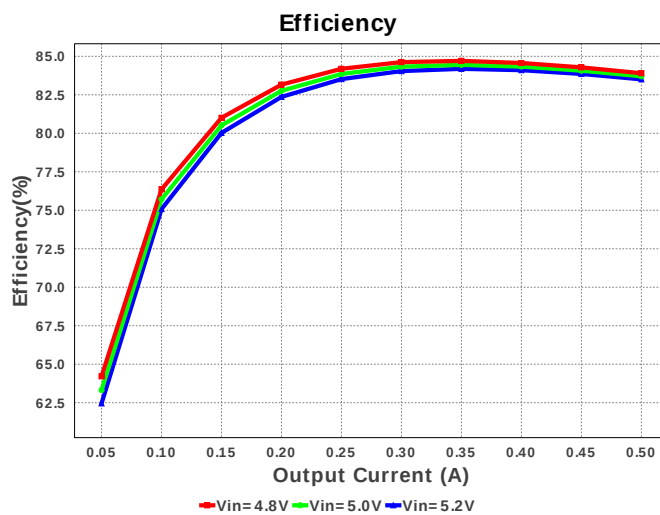
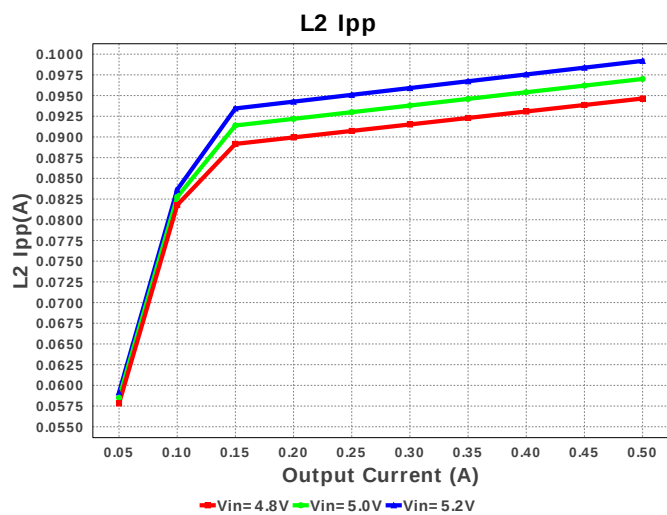
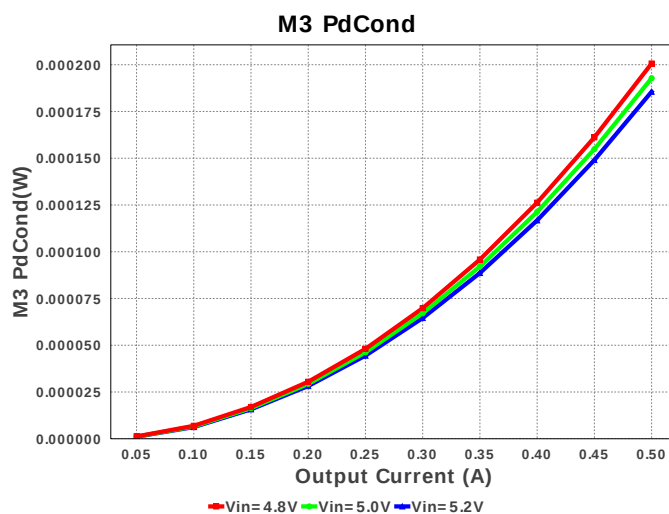
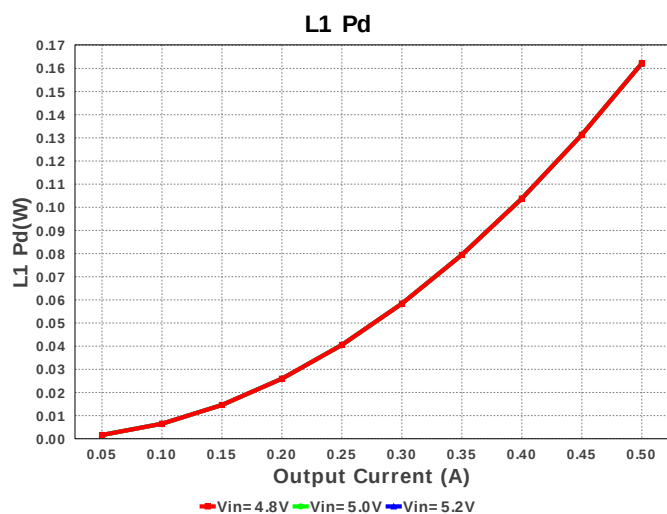
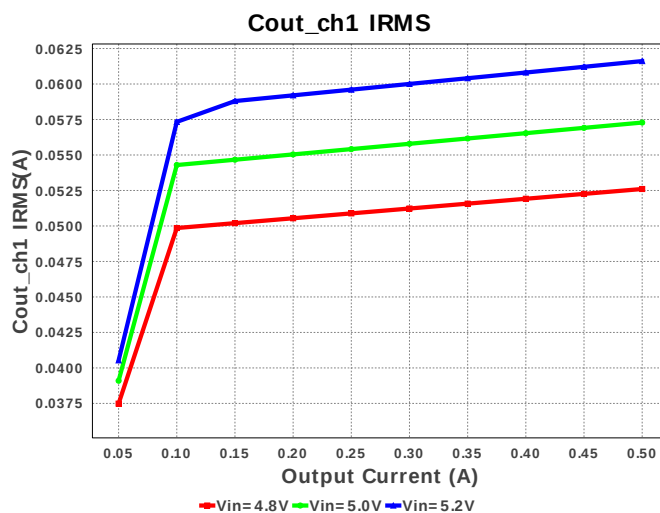
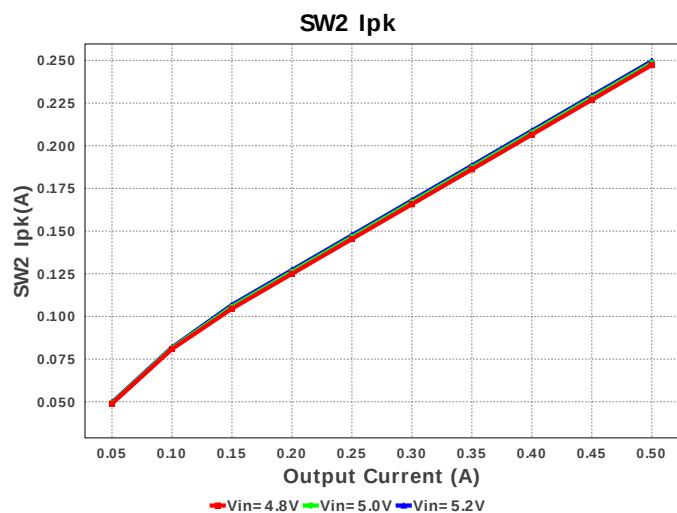


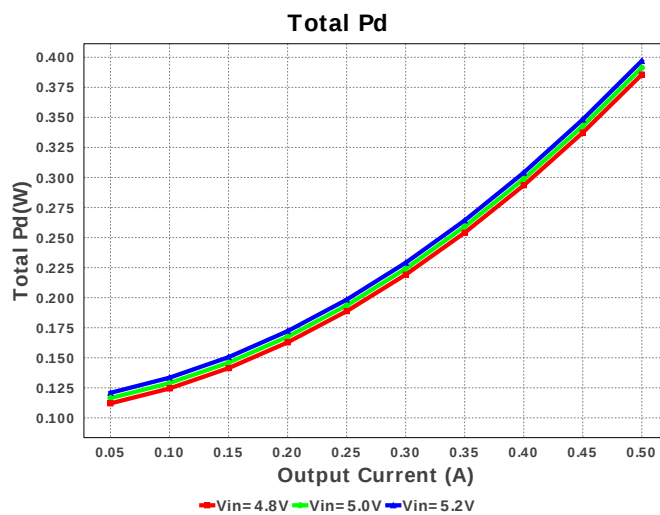
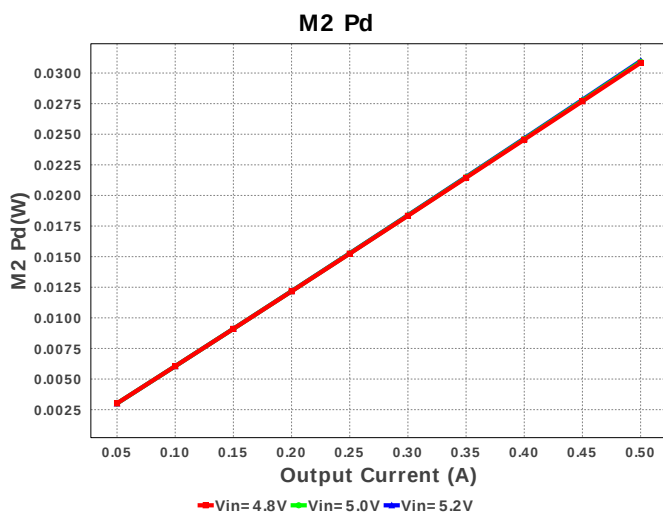
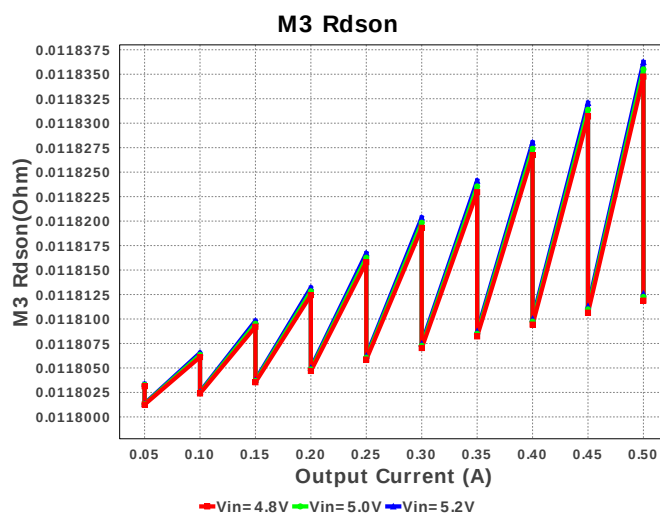
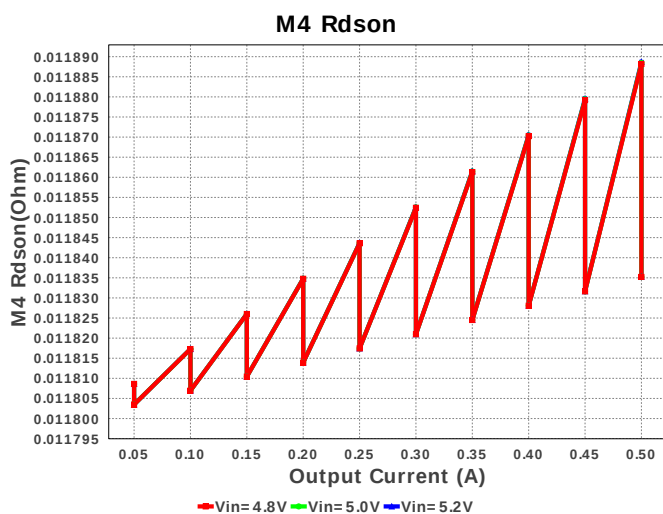
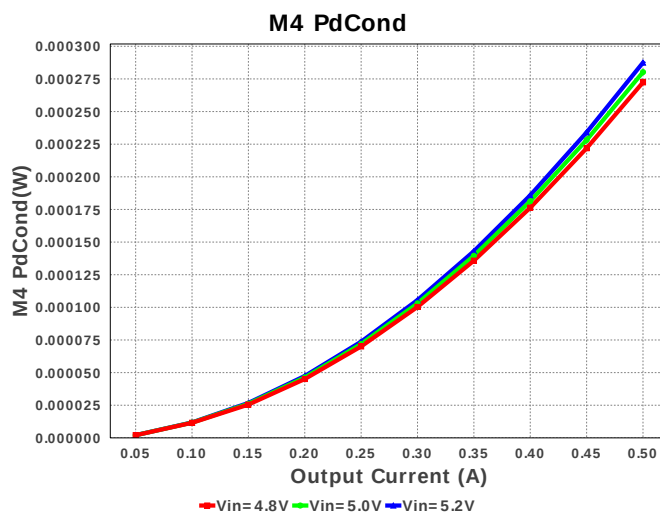
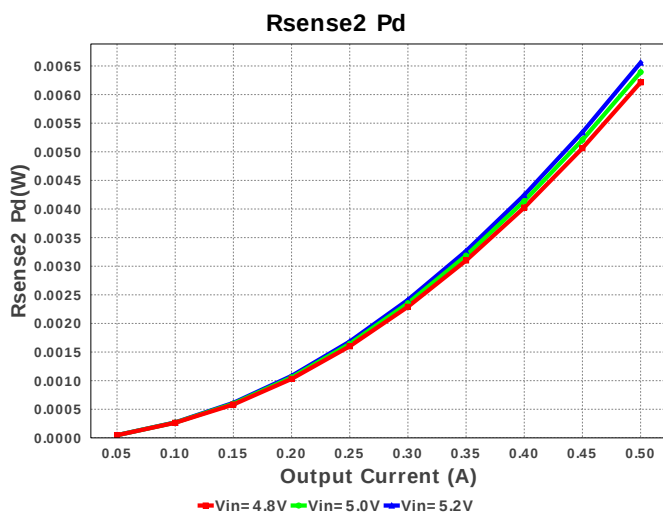
M4 Pd

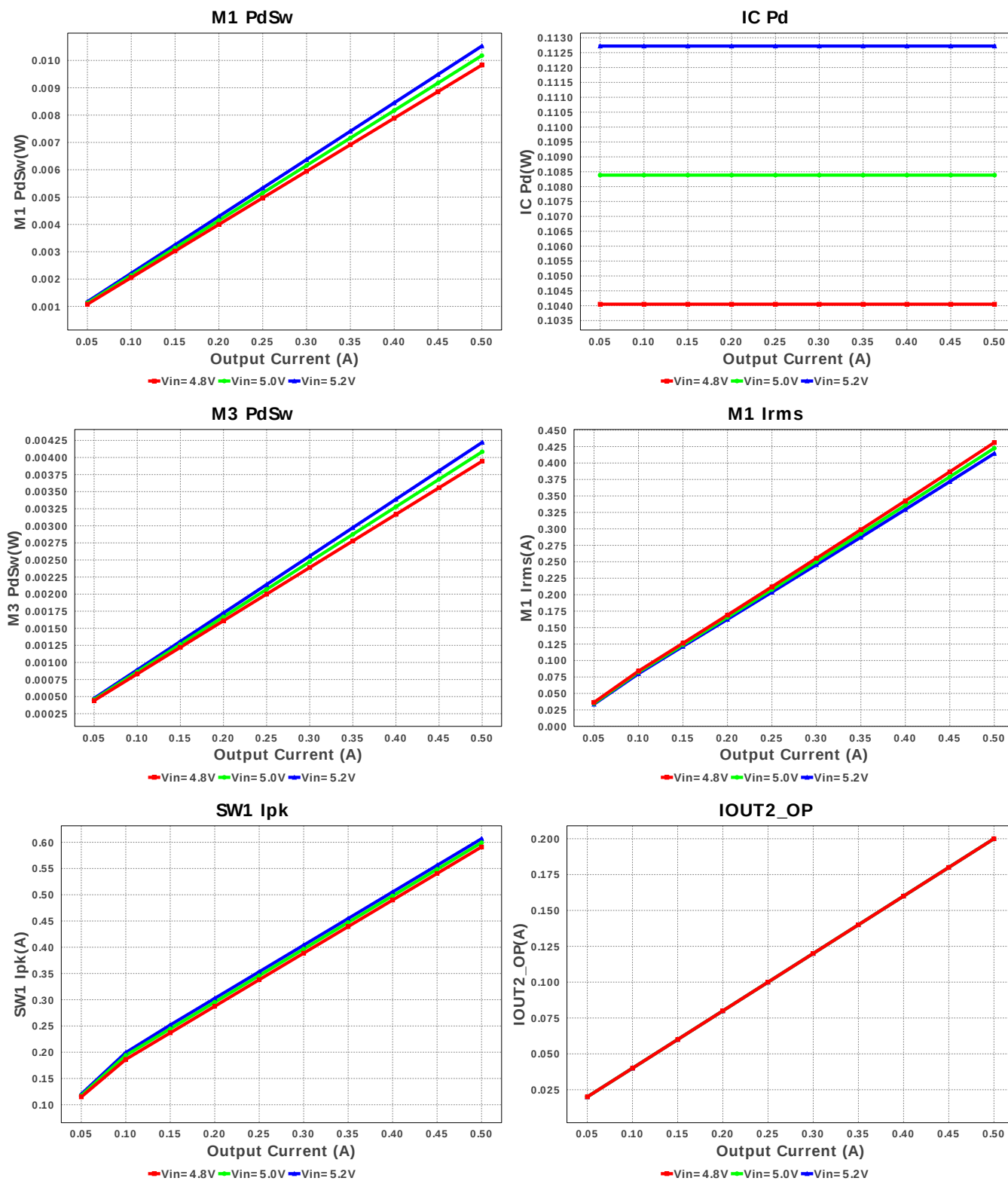


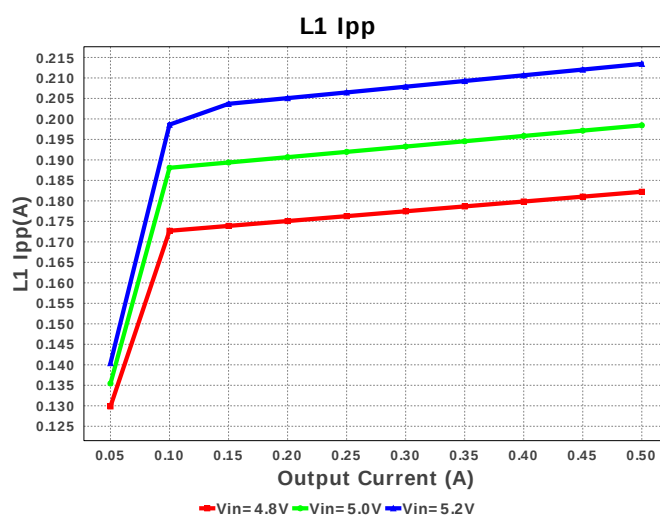
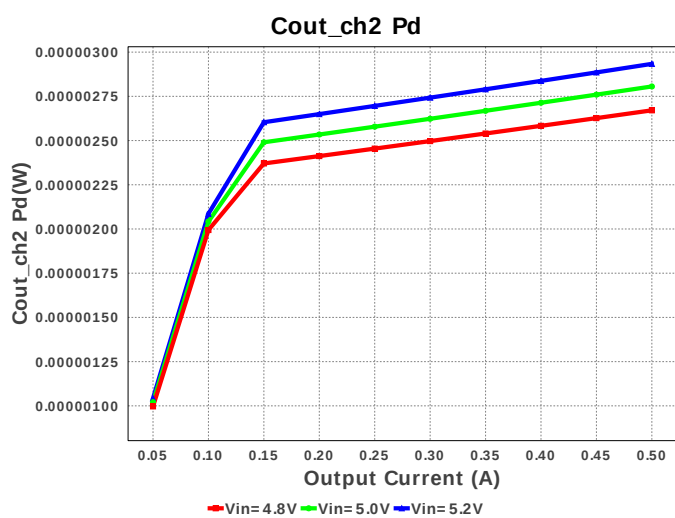
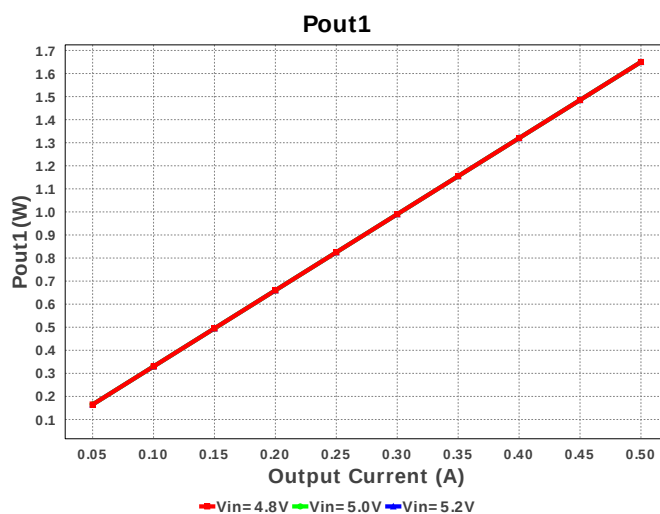
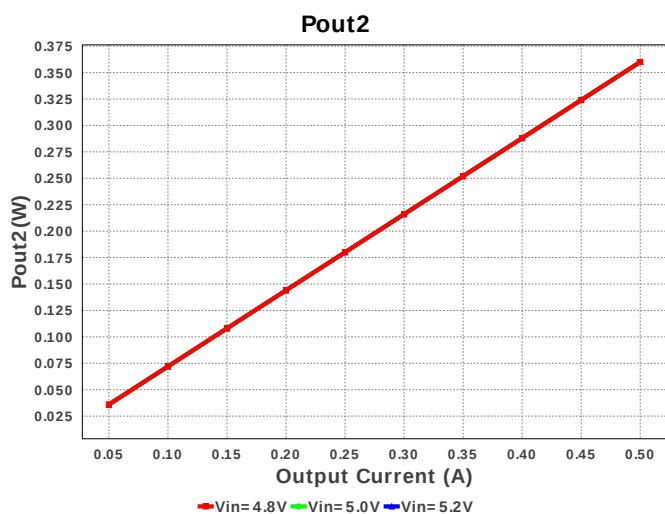
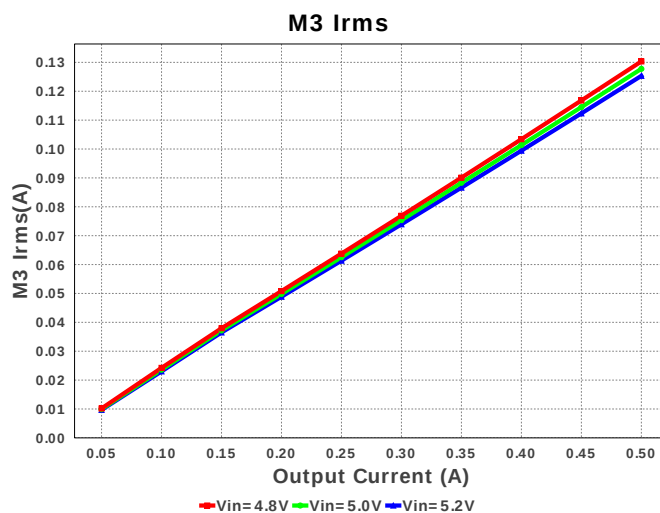
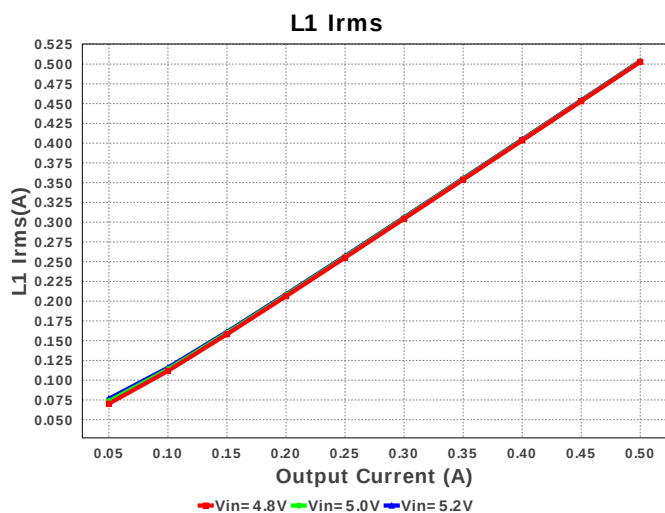
M2 PdCond



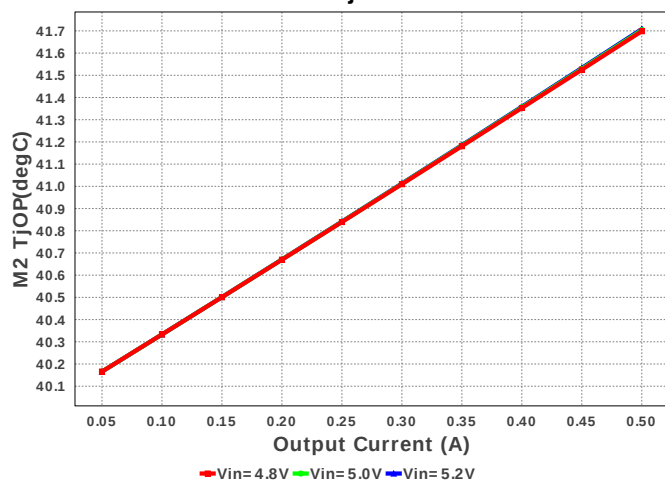




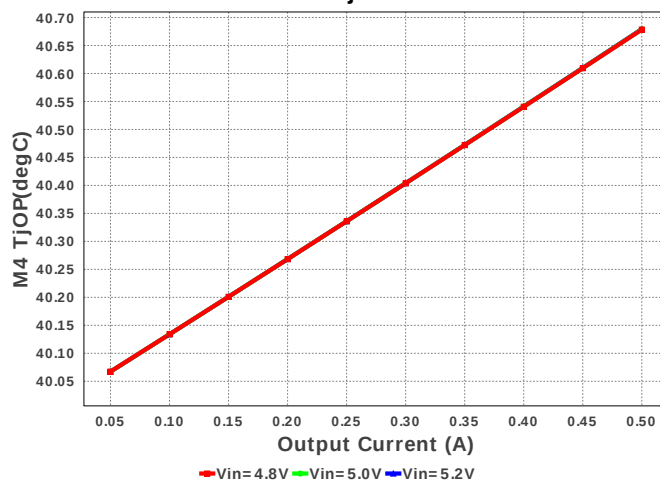




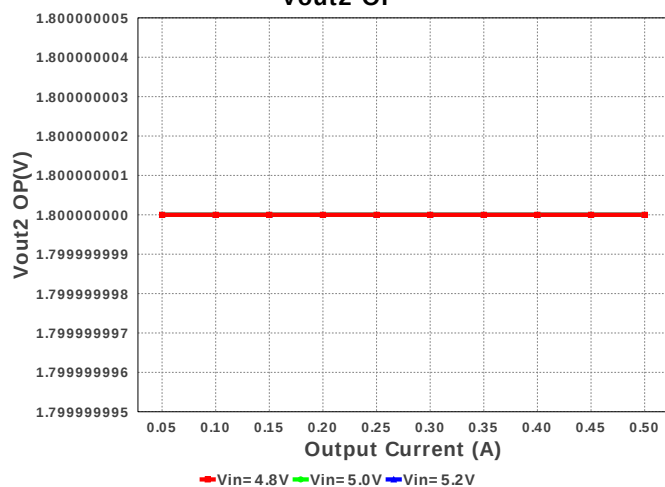
M2 TjOP



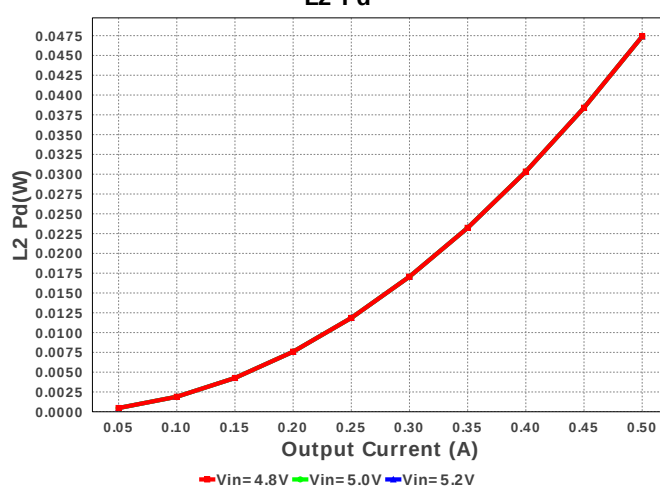
M4 TjOP



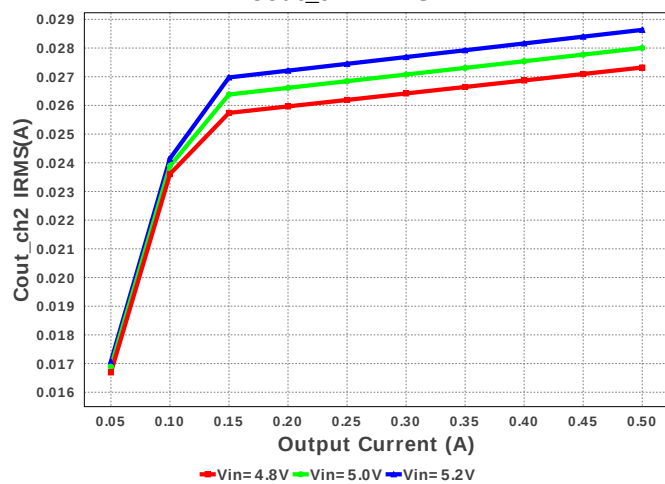
Vout2 OP



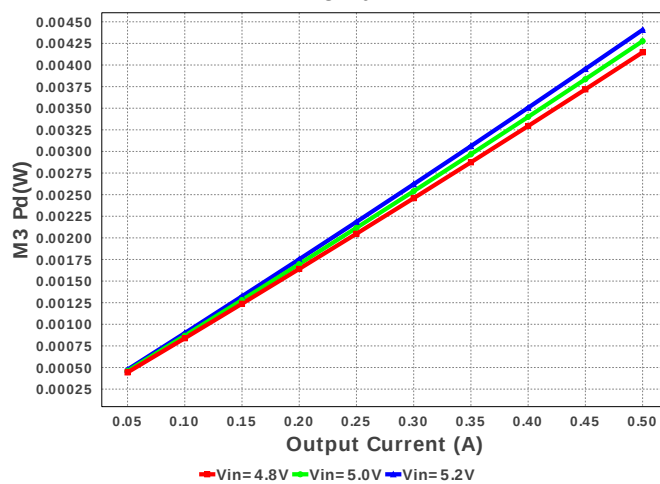
L2 Pd

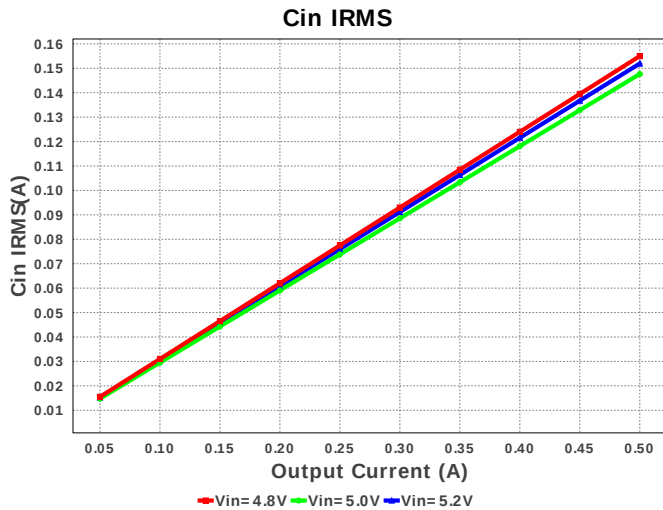


Cout_ch2 IRMS



M3 Pd





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	151.947 mA	Current	Input capacitor RMS ripple current
2.	Cout_ch1 IRMS	61.614 mA	Current	Output Channel 1 Capacitor RMS ripple current
3.	Cout_ch2 IRMS	28.634 mA	Current	Output Channel 2 Capacitor RMS ripple current
4.	Iin Avg	462.89 mA	Current	Average input current
5.	L1 Ipp	213.436 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	503.782 mA	Current	Inductor ripple current
7.	L2Ipp	99.19 mA	Current	Channel 2 Inductor Peak to peak Current
8.	L2 Irms	202.039 mA	Current	Inductor ripple current
9.	M1 Irms	414.527 mA	Current	MOSFET RMS ripple current
10.	M2 Irms	279.584 mA	Current	MOSFET RMS ripple current
11.	M3 Irms	125.332 mA	Current	MOSFET RMS ripple current
12.	M4 Irms	155.858 mA	Current	MOSFET RMS ripple current
13.	SW1 Ipk	606.718 mA	Current	Peak switch current
14.	SW2 Ipk	249.595 mA	Current	Peak switch current
15.	BOM Count	40	General	Total Design BOM count
16.	FootPrint	322.0 mm ²	General	Total Foot Print Area of BOM components
17.	Frequency	407.907 kHz	General	Switching frequency
18.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
19.	Pout1	1.65 W	General	Channel 1 output Power
20.	Pout2	360.0 mW	General	Channel 2 output Power
21.	Total BOM	\$4.76	General	Total BOM Cost
22.	Ch1 Mode	CCM	General	Conduction Mode
23.	Ch2 Mode	CCM	General	Conduction Mode
24.	M3 TJOP	40.243 degC	Op_Point	M3 MOSFET junction temperature
25.	M4 TJOP	40.679 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	68.733 %	Op_point	Duty cycle for Channel 1
28.	Duty Cycle 2	39.27 %	Op_point	Duty cycle for Channel 2
29.	Efficiency	83.505 %	Op_point	Steady state efficiency
30.	IC Tj	44.509 degC	Op_point	IC junction temperature
31.	IOUT1_OP	500.0 mA	Op_point	Iout1 operating point
32.	IOUT2_OP	200.0 mA	Op_point	Iout2 operating point
33.	M1 TJOP	40.698 degC	Op_point	M1 MOSFET junction temperature
34.	M2 TJOP	41.708 degC	Op_point	M2 MOSFET junction temperature
35.	VIN_OP	5.2 V	Op_point	Vin operating point
36.	Vout1 OP	3.3 V	Op_point	Operational Voltage 1
37.	Vout1 p-p	1.535 mV	Op_point	Peak-to-peak output1 ripple voltage
38.	Vout2 OP	1.8 V	Op_point	Operational Voltage 2
39.	Vout2 p-p	1.426 mV	Op_point	Peak-to-peak output2 ripple voltage
40.	Cin Pd	83.971 μW	Power	Input capacitor power dissipation
41.	Cout_ch1 Pd	3.396 μW	Power	Output channel 1 capacitor power dissipation
42.	Cout_ch2 Pd	2.934 μW	Power	Output channel 2 capacitor power dissipation
43.	IC Pd	112.721 mW	Power	IC power dissipation
44.	L1 Pd	162.158 mW	Power	Inductor power dissipation
45.	L2 Pd	47.4 mW	Power	Inductor power dissipation
46.	M1 Pd	12.561 mW	Power	M1 MOSFET total power dissipation
47.	M1 PdCond	2.034 mW	Power	M1 MOSFET conduction losses
48.	M1 PdSw	10.527 mW	Power	M1 MOSFET switching losses
49.	M2 Pd	30.994 mW	Power	M2 MOSFET total power dissipation
50.	M2 PdCond	929.305 μW	Power	M2 MOSFET conduction losses
51.	M2 PdSw	30.065 mW	Power	M2 MOSFET switching losses
52.	M3 Pd	4.407 mW	Power	M3 MOSFET total power dissipation

#	Name	Value	Category	Description
53.	M3 PdCond	185.555 μ W	Power	M3 MOSFET conduction losses
54.	M3 PdSw	4.221 mW	Power	M3 MOSFET switching losses
55.	M1 Rdson	11.836 mOhm	Power	Drain-Source On-resistance
56.	M3 Rdson	11.813 mOhm	Power	Drain-Source On-resistance
57.	M4 Pd	12.333 mW	Power	M4 MOSFET total power dissipation
58.	M4 PdCond	287.5 μ W	Power	M4 MOSFET conduction losses
59.	M4 PdSw	12.045 mW	Power	M4 MOSFET switching losses
60.	M2 Rdson	11.889 mOhm	Power	Drain-Source On-resistance
61.	M4 Rdson	11.835 mOhm	Power	Drain-Source On-resistance
62.	Rsense1 Pd	7.817 mW	Power	Current Limit Sense Resistor Power Dissipation
63.	Rsense2 Pd	6.559 mW	Power	Current Limit Sense Resistor Power Dissipation
64.	Total Pd	397.04 mW	Power	Total Power Dissipation
65.	Cross Freq Ch1	36.757 kHz		Bode plot crossover frequency
66.	Cross Freq Ch2	37.023 kHz		Bode plot crossover frequency
67.	Phase Marg Ch1	56.962 deg		Bode Plot Phase Margin
68.	Phase Marg Ch2	63.12 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	500.0 m	Maximum Output Current
2.	Iout1	500.0 m	Output Current #1
3.	Iout2	200.0 m	Output Current #2
4.	VinMax	5.2	Maximum input voltage
5.	VinMin	4.8	Minimum input voltage
6.	Vout	3.3	Output Voltage
7.	Vout1	3.3	Output Voltage #1
8.	Vout2	1.8	Output Voltage #2
9.	base_pn	LM25119	Base Product Number
10.	source	DC	Input Source Type
11.	Ta	40.0	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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