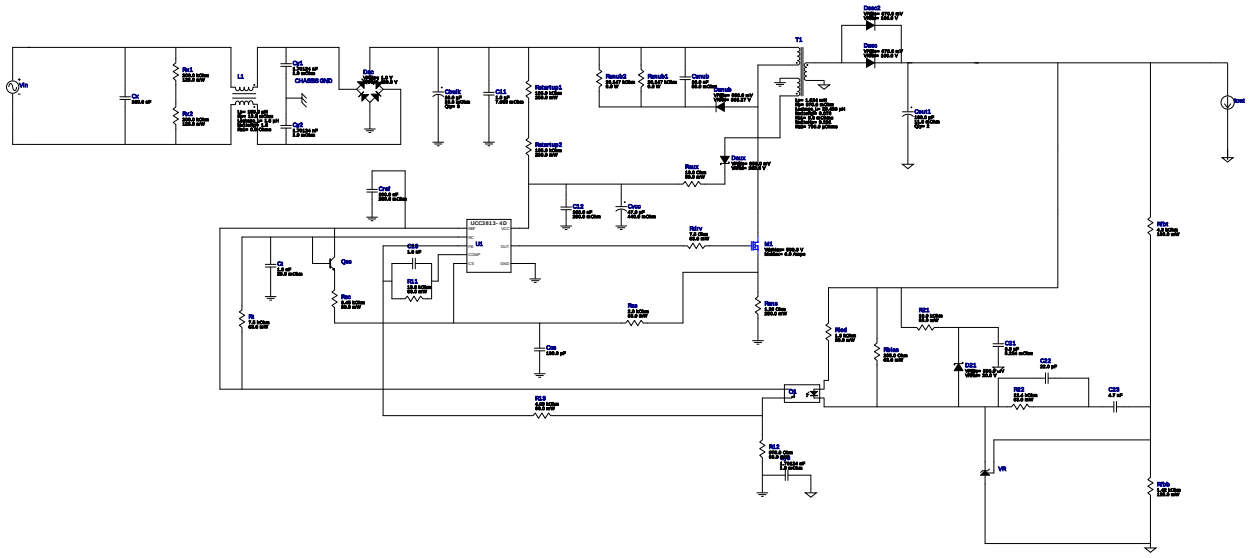
WEBENCH® Design Report

VinMin = 110.0V
VinMax = 130.0V
Vout = 5.0V
Iout = 3.0A

Device = UCC3813DTR-4
Topology = Flyback
Created = 9/28/16 6:25:59 AM
BOM Cost = $0.00
BOM Count = 54
Total Pd = 2.87W

Design : 4652143/12 UCC3813DTR-4
UCC3813DTR-4 110.0V-130.0V to 5.00V @ 3.0A

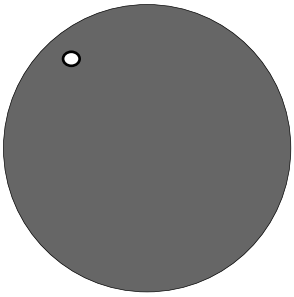
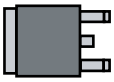


1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.

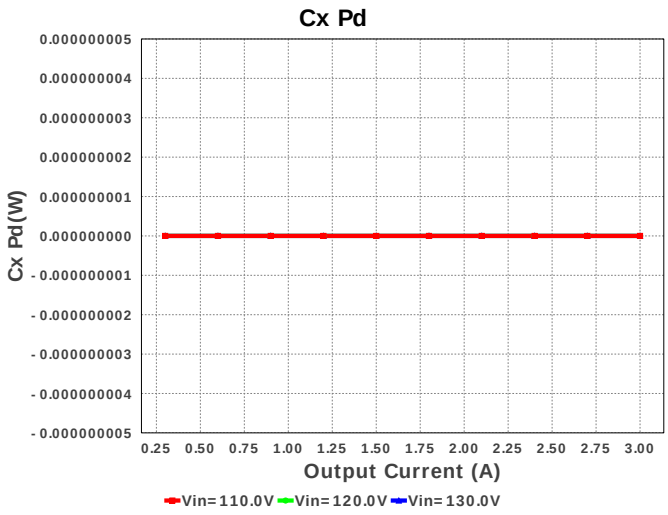
Electrical BOM

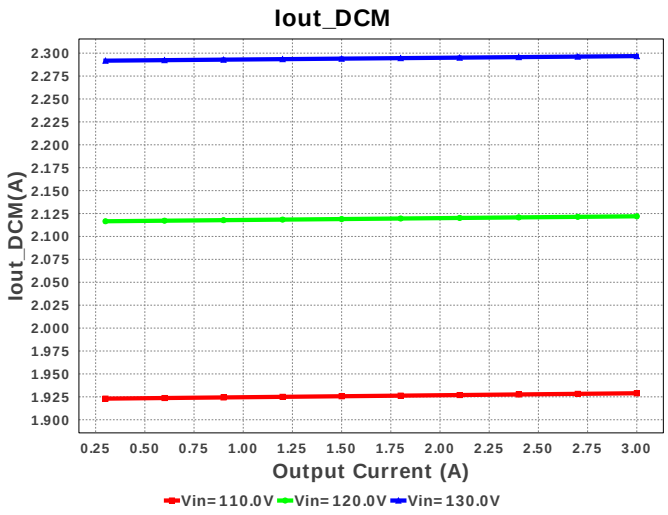
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C11	MuRata	GRM55DR72E105KW01L Series= X7R	Cap= 1.0 uF ESR= 7.086 mOhm VDC= 250.0 V IRMS= 2.0605 A	1	$0.26	2220_200 54 mm²
2.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	C13	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	C21	MuRata	GRM31MR61C685KA12L Series= X5R	Cap= 6.8 uF ESR= 5.224 mOhm VDC= 16.0 V IRMS= 2.158 A	1	$0.17	1206 11 mm²
5.	C22	Kemet	C0805C220K3GACTU Series= C0G/NP0	Cap= 22.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
6.	C23	Yageo America	CC0805KRX7R9BB472 Series= X7R	Cap= 4.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
7.	Cbulk	Rubycon	200RX3010M8X16 Series= ?	Cap= 10.0 uF ESR= 19.8 mOhm VDC= 200.0 V IRMS= 200.0 mA	3	$0.18	RX30_800x1600 100 mm²
8.	Ccs	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²

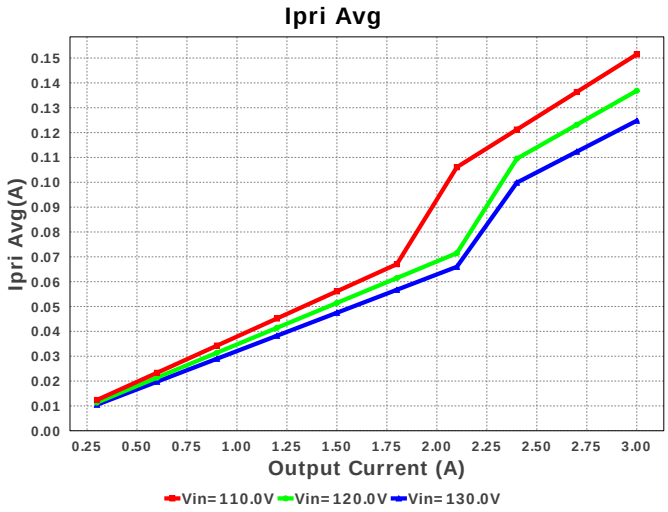
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cout1	Panasonic	16SVPE180M Series= SVPE	Cap= 180.0 uF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 4.46 A	2	$0.49	 CAPSMT_62_C10 74 mm^2
10.	Cref	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm^2
11.	Csnub	AVX	1812SC103KAT1A Series= X7R	Cap= 10.0 nF ESR= 50.0 mOhm VDC= 1.5 kV IRMS= 0.0 A	1	$0.37	 1812 23 mm^2
12.	Ct	Kemet	C0805C102J5GACTU Series= C0G/NP0	Cap= 1.0 nF ESR= 25.0 mOhm VDC= 50.0 V IRMS= 1.71 A	1	$0.01	 0805 7 mm^2
13.	Cvcc	Nichicon	UUD1E470MCL1GS Series= uD	Cap= 47.0 uF ESR= 440.0 mOhm VDC= 25.0 V IRMS= 230.0 mA	1	$0.11	 SM_RADIAL_6.3AMM 80 mm^2
14.	Cx	TDK	B32913A5104M000 Series= 2231	Cap= 100.0 nF VDC= 1000.0 V IRMS= 0.0 A	1	$0.46	 B32913_2650x600x1500 228 mm^2
15.	Cy1	CUSTOM	CUSTOM Series= ?	Cap= 1.70124 nF ESR= 1.0 mOhm VDC= 220.62 V IRMS= 500.0 uA	1	NA	CUSTOM 0 mm^2
16.	Cy2	CUSTOM	CUSTOM Series= ?	Cap= 1.70124 nF ESR= 1.0 mOhm VDC= 220.62 V IRMS= 500.0 uA	1	NA	CUSTOM 0 mm^2
17.	Cy3	CUSTOM	CUSTOM Series= ?	Cap= 1.70124 nF ESR= 1.0 mOhm VDC= 220.62 V IRMS= 500.0 uA	1	NA	CUSTOM 0 mm^2
18.	D21	Diodes Inc.	B220-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	$0.08	 SMB 44 mm^2
19.	Dac	Diodes Inc.	HD04-T	VF@Io= 1.0 V VRRM= 400.0 V	1	$0.12	 MiniDIP 62 mm^2
20.	Daux	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	$0.21	 PowerDI123 13 mm^2
21.	Dsec	Fairchild Semiconductor	FSV8100V	VF@Io= 670.0 mV VRRM= 100.0 V	1	$0.21	 TO-277A 56 mm^2
22.	Dsec2	Fairchild Semiconductor	FSV8100V	VF@Io= 670.0 mV VRRM= 100.0 V	1	$0.21	 TO-277A 56 mm^2
23.	Dsnub	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 363.27 V	1	NA	CUSTOM 0 mm^2

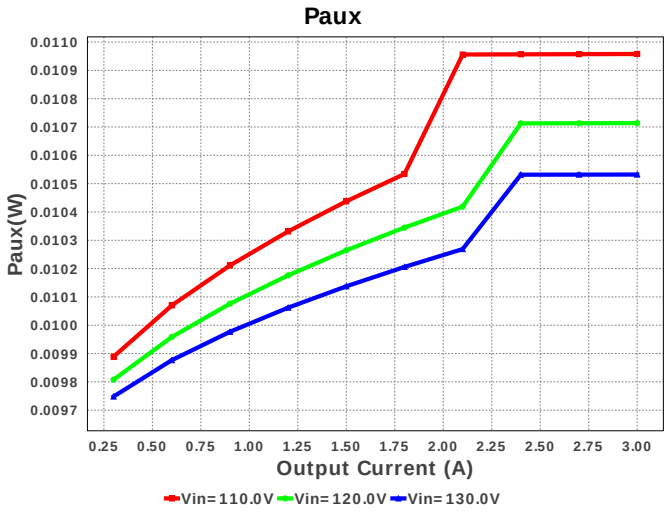
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
24.	L1	API Delevan	CM6296R-154	Lp= 150.0 µH Rp= 16.0 mOhm Leakage_L= 1.8 µH Ns1toNp= 1.0 Rs1= 0.0 Ohms	1	$6.32	 CM6296 833 mm^2
25.	M1	Fairchild Semiconductor	FDD6N50TM	VdsMax= 500.0 V IdsMax= 6.0 Amps	1	$0.47	 DPAK 102 mm^2
26.	O1	Vishay-Semiconductor	TCMT1109	Optocoupler	1	$0.21	 SOP-4 44 mm^2
27.	Qsc	STMicroelectronics	2N2222A	Bipolar Transistor	1	$0.97	 TO-18 57 mm^2
28.	R11	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
29.	R12	Vishay-Dale	CRCW0402976RFKED Series= CRCW..e3	Res= 976.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
30.	R13	Vishay-Dale	CRCW04024K99FKED Series= CRCW..e3	Res= 4.99 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
31.	R21	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
32.	R22	Vishay-Dale	CRCW040212K4FKED Series= CRCW..e3	Res= 12.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
33.	Raux	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
34.	Rbias	Vishay-Dale	CRCW0402205RFKED Series= CRCW..e3	Res= 205.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
35.	Rcs	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
36.	Rdrv	Vishay-Dale	CRCW04027R50FKED Series= CRCW..e3	Res= 7.5 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
37.	Rfbb	Yageo America	RT0805BRD071K42L Series= RT0805	Res= 1.42 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	0805 7 mm^2
38.	Rfbt	Yageo America	RC0603FR-074K3L Series= ?	Res= 4.3 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
39.	Rled	Vishay-Dale	CRCW04021K30FKED Series= CRCW..e3	Res= 1.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
40.	Rsc	Vishay-Dale	CRCW04028K45FKED Series= CRCW..e3	Res= 8.45 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2

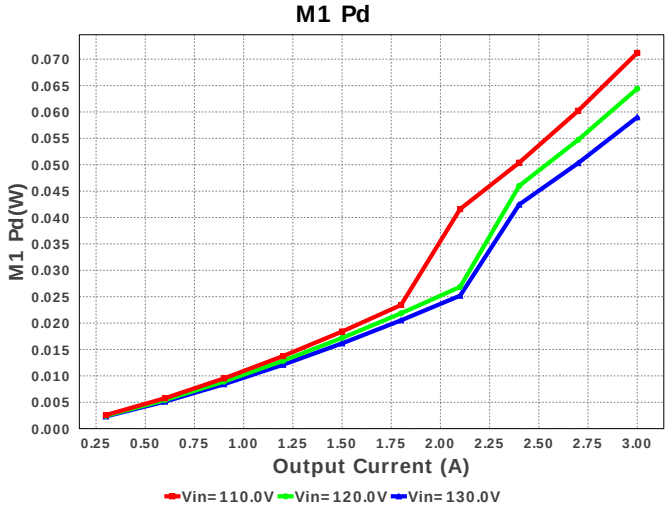
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
41.	Rsns	Vishay-Dale	CRCW12061R18FKEA Series= CRCW..e3	Res= 1.18 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
42.	Rsnub1	CUSTOM	CUSTOM Series= ?	Res= 29.147 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
43.	Rsnub2	CUSTOM	CUSTOM Series= ?	Res= 29.147 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
44.	Rstartup1	Panasonic	ERJ-8ENF1053V Series= ERJ-8E	Res= 105.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
45.	Rstartup2	Panasonic	ERJ-8ENF1053V Series= ERJ-8E	Res= 105.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
46.	Rt	Vishay-Dale	CRCW04027K50FKED Series= CRCW..e3	Res= 7.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
47.	Rx1	Panasonic	ERJ-6ENF2003V Series= ERJ-6E	Res= 200.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
48.	Rx2	Panasonic	ERJ-6ENF2003V Series= ERJ-6E	Res= 200.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
49.	T1	CUSTOM	CUSTOM	Lp= 1.024 mH Rp= 870.0 mOhm Leakage_L= 20.486 µH Ns1toNp= 0.076 Rs1= 8.6 mOhms Ns2toNp= 0.201 Rs2= 700.0 µOhms	1	NA	CUSTOM 0 mm^2
50.	U1	Texas Instruments	UCC3813DTR-4	Switcher	1	$0.99	 D0008A 57 mm^2
51.	VR	Texas Instruments	LMV431CM5/NOPB	Voltage References	1	$0.16	 R-PDSO-G3 16 mm^2

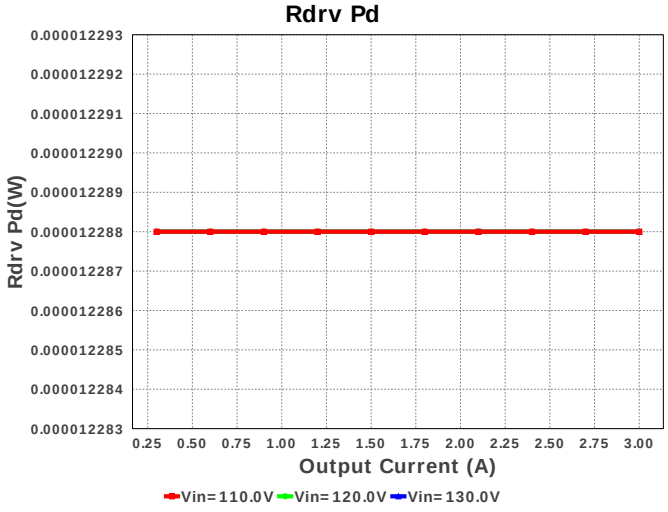


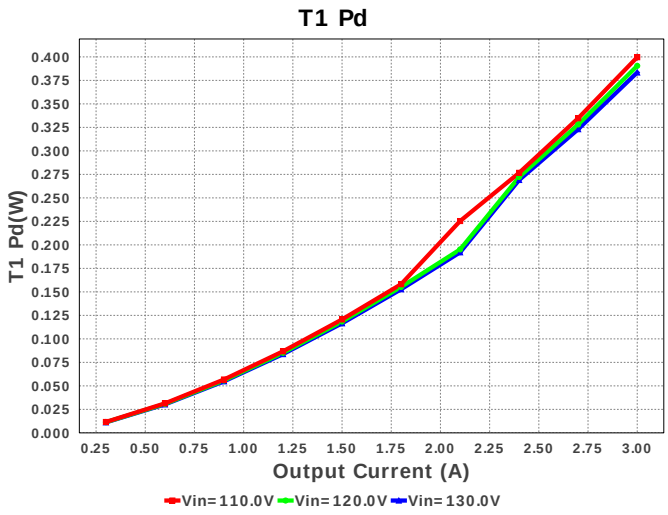


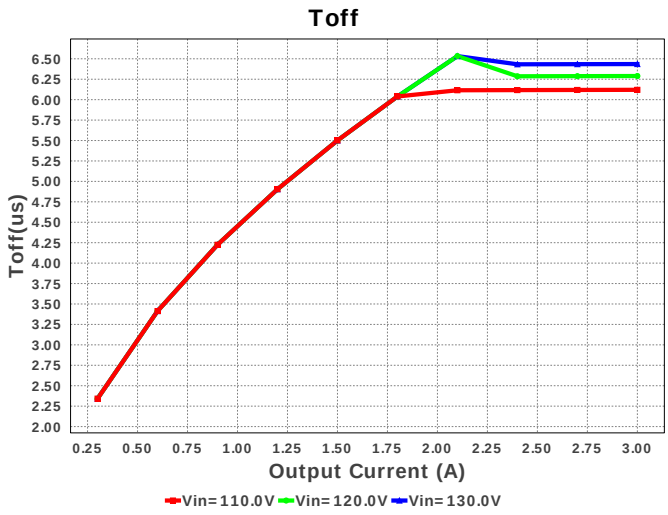


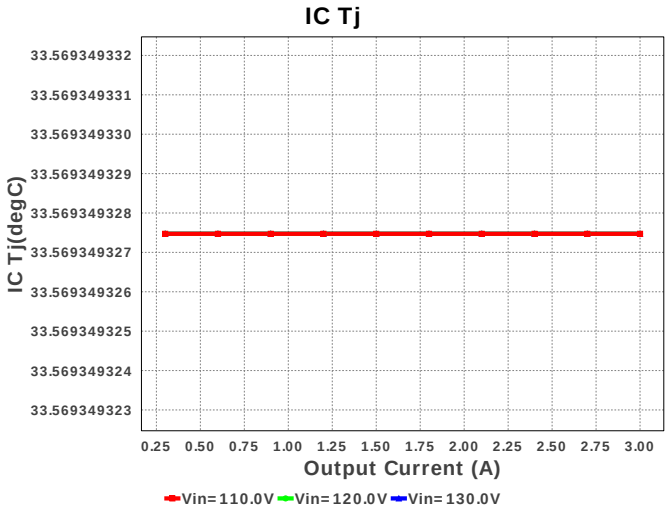


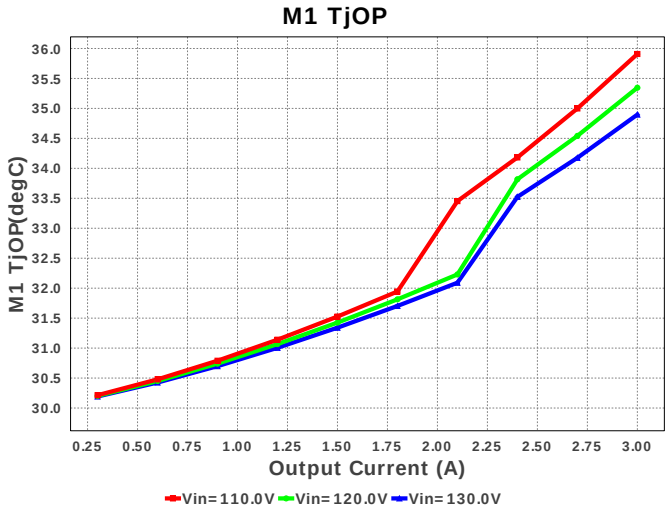


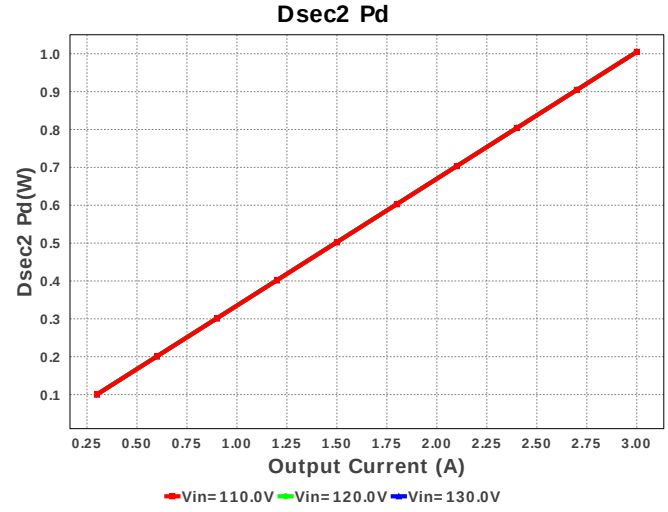


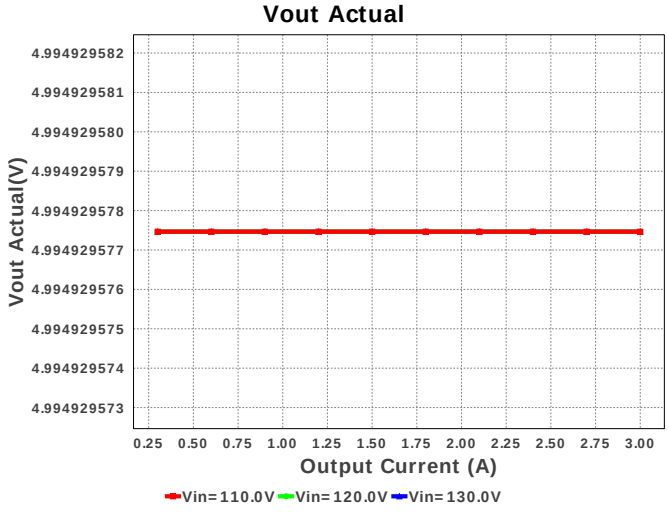


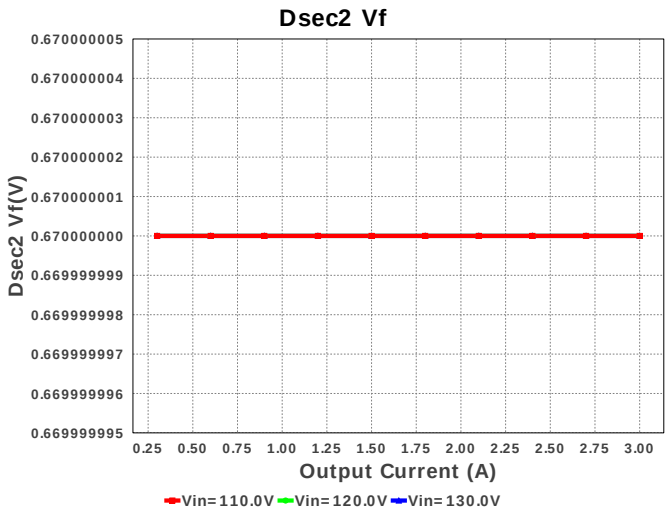


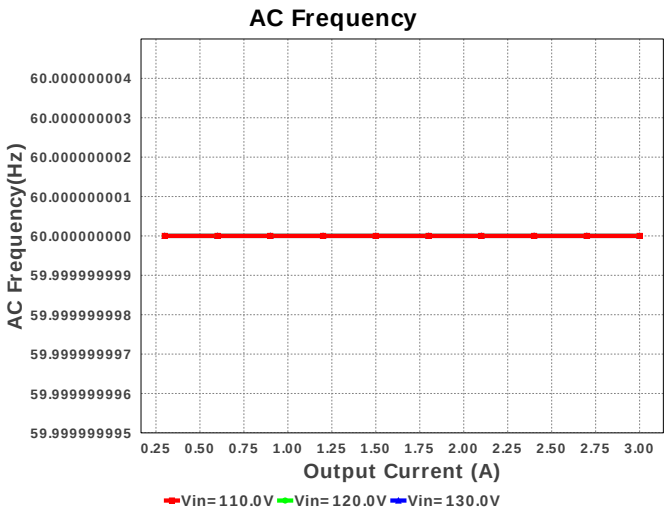


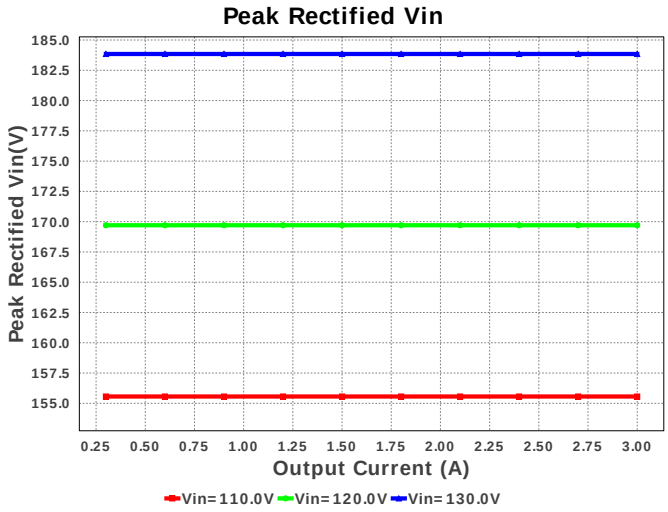


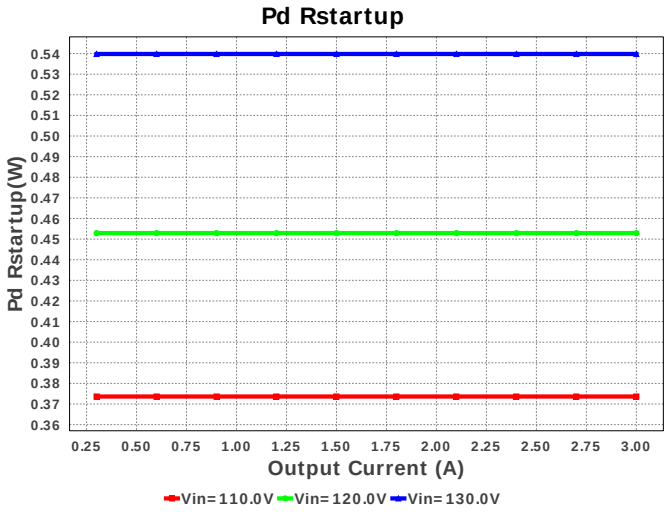


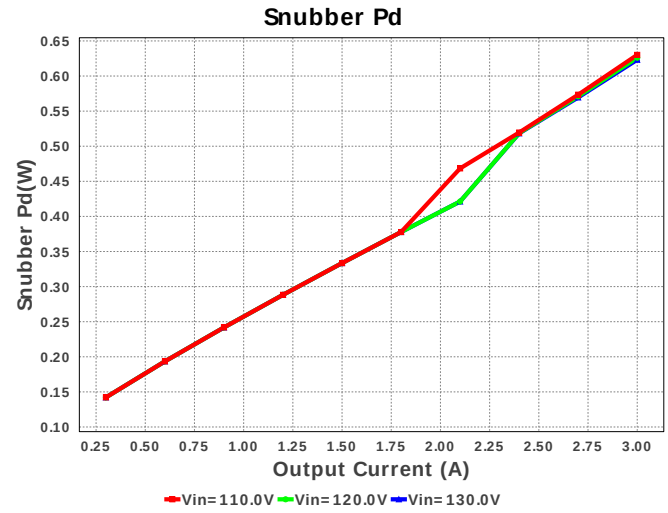


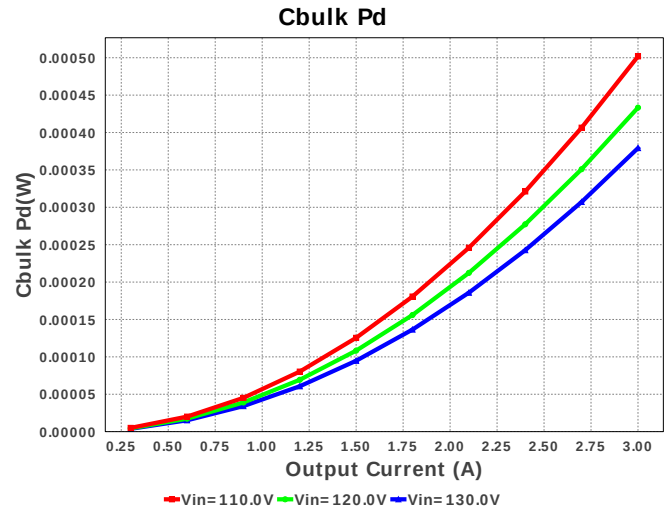


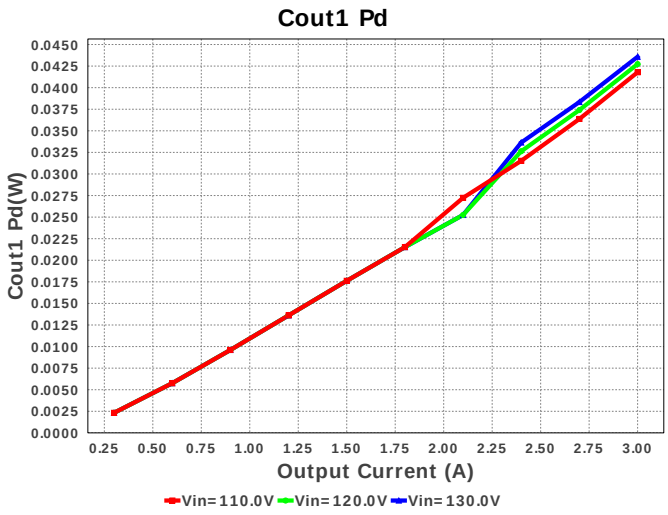


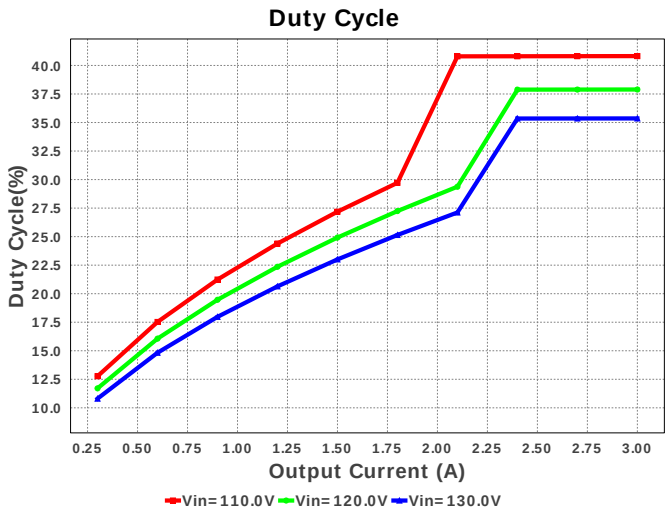


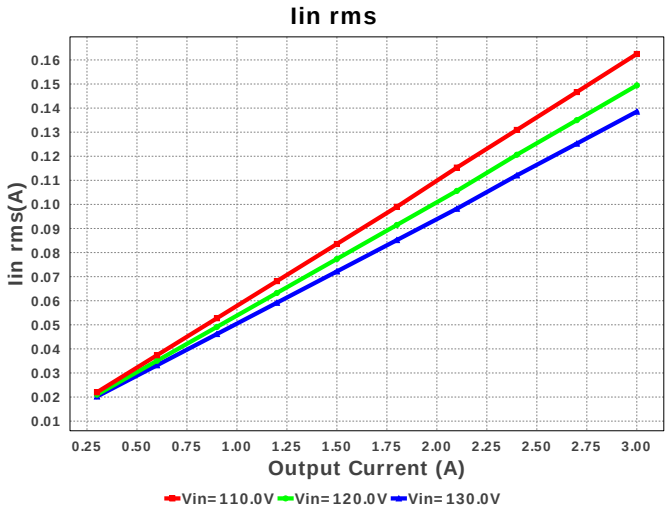


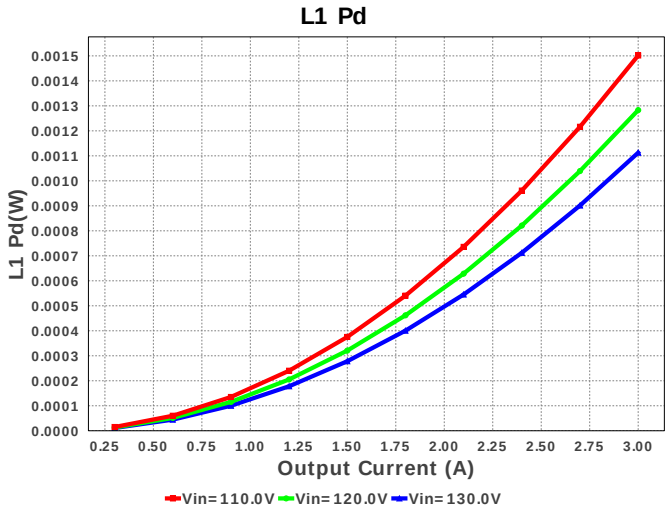


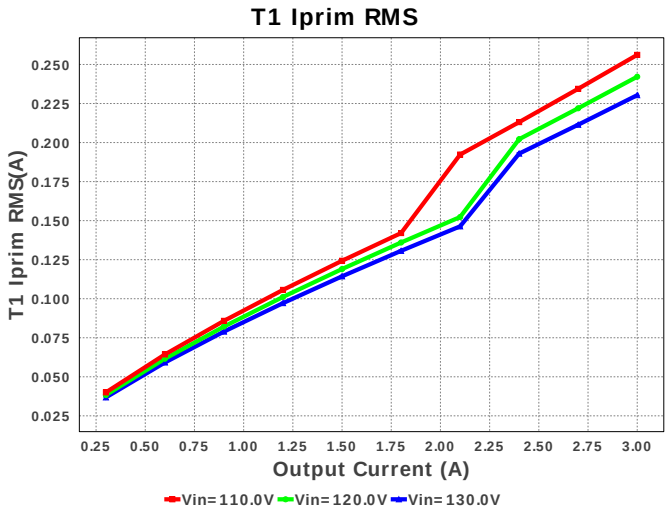


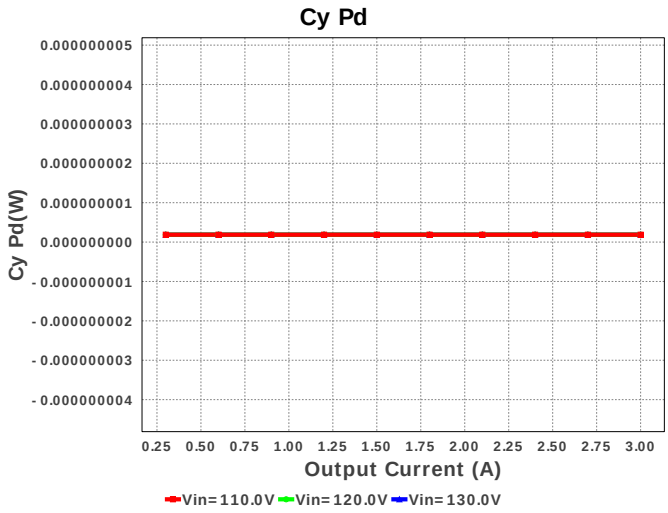


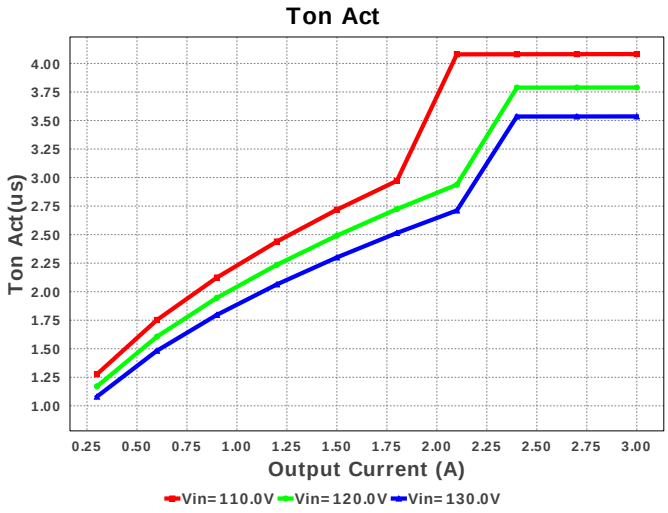


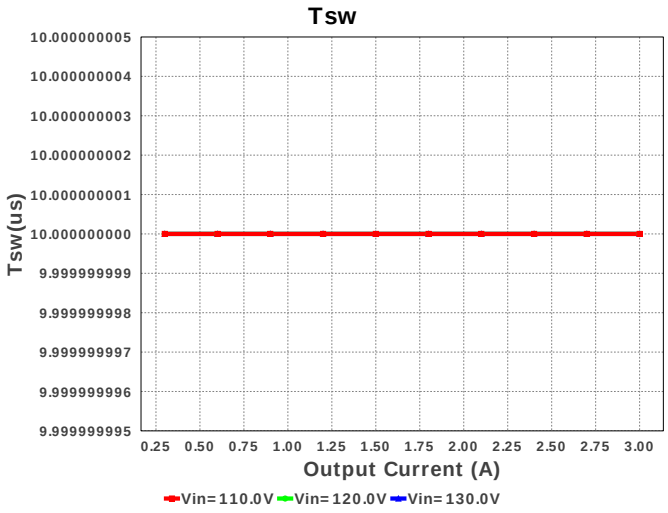


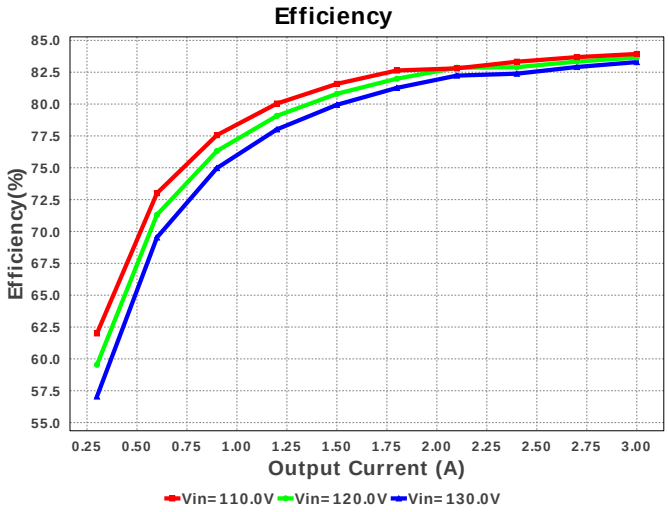


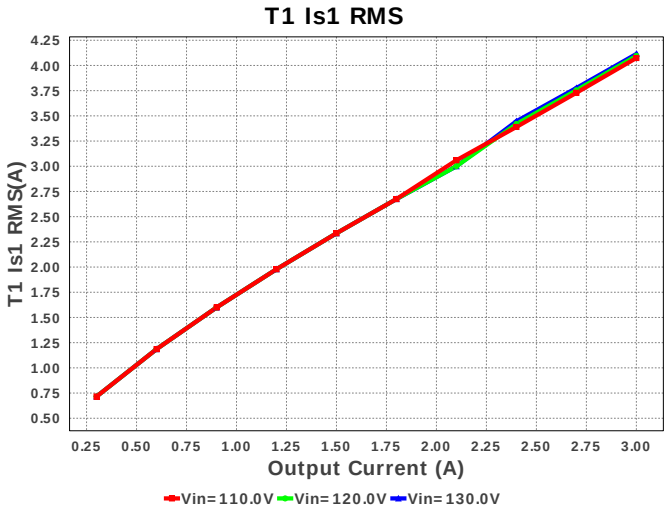


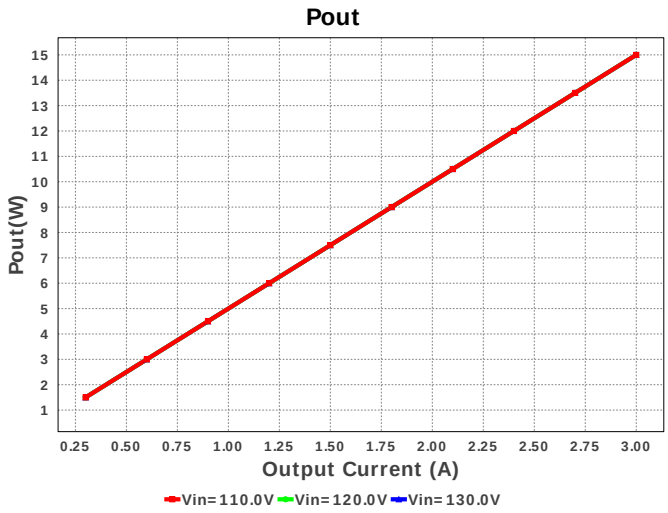


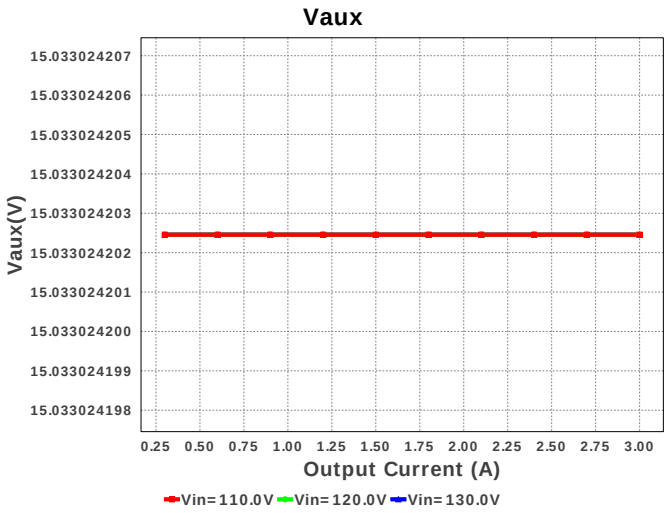


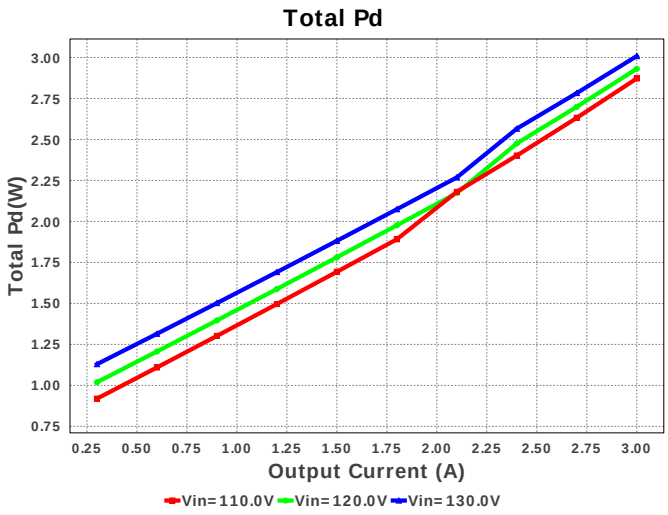


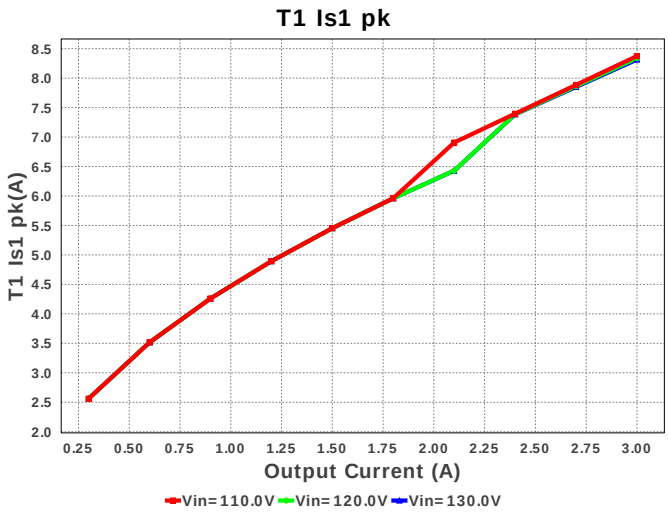


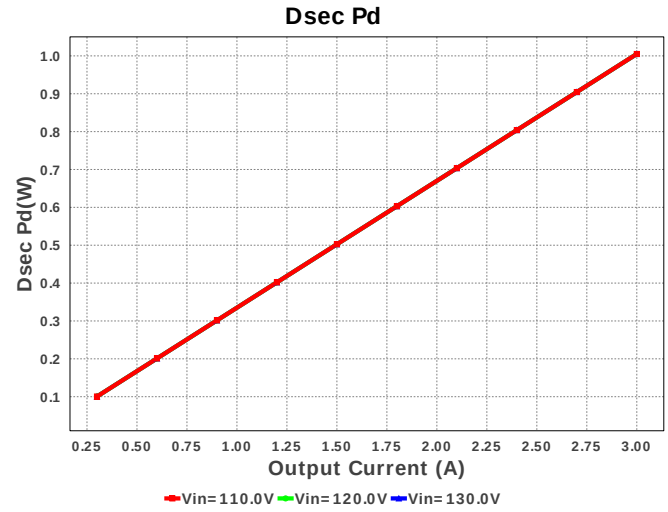


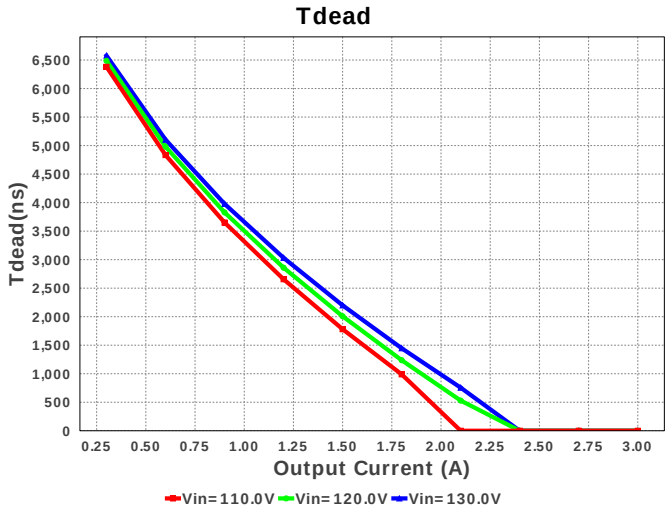


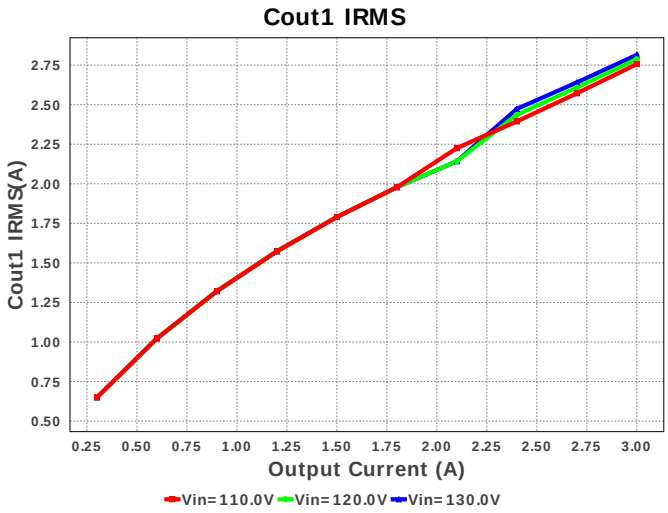


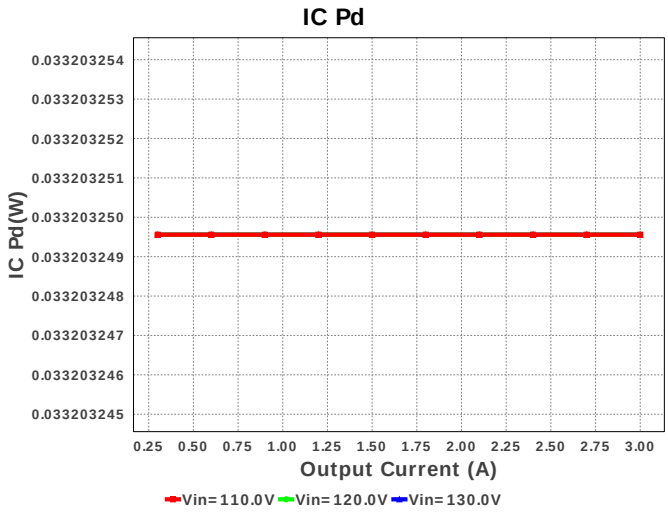


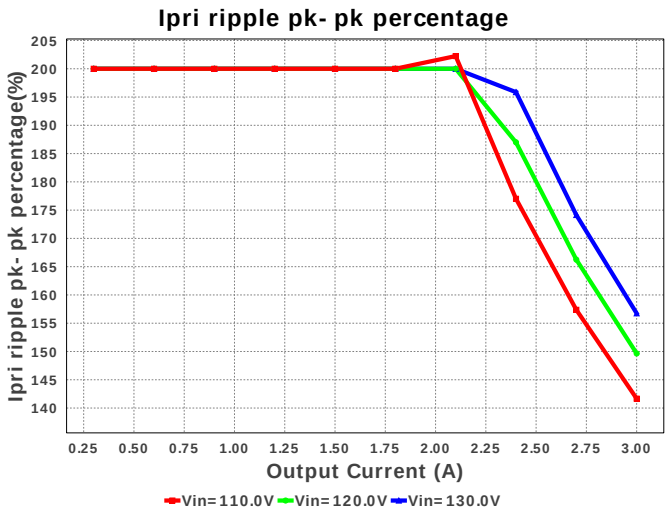


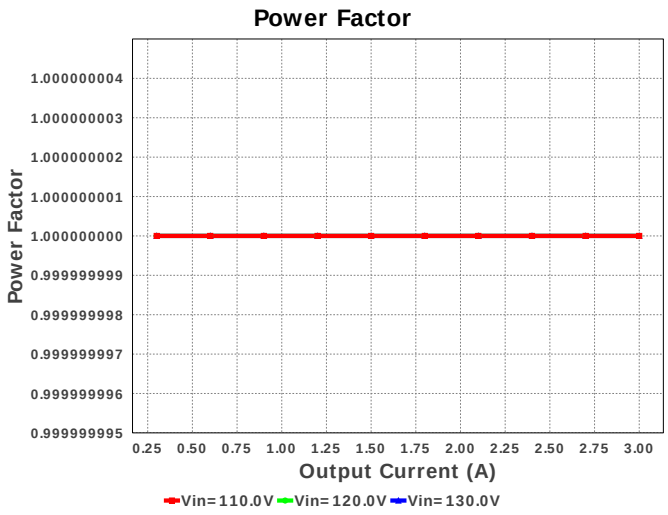


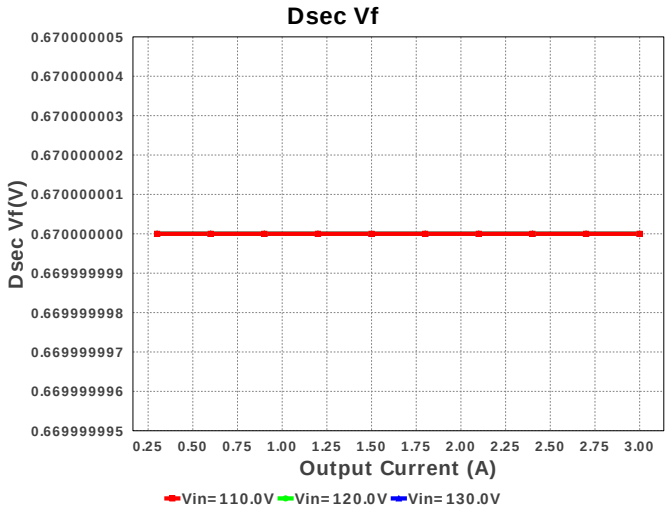


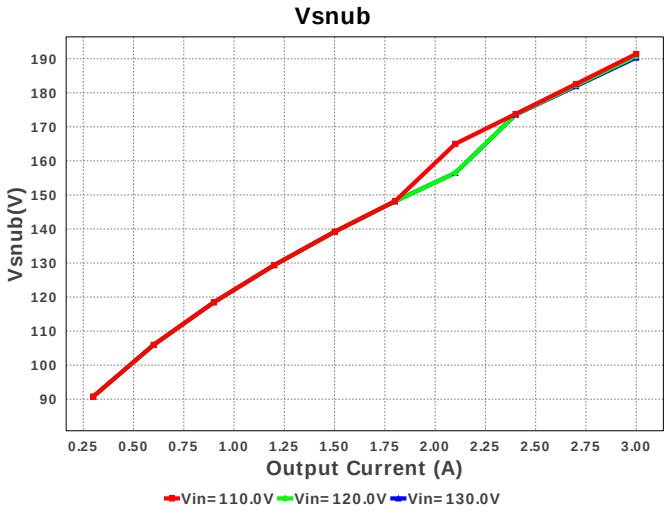


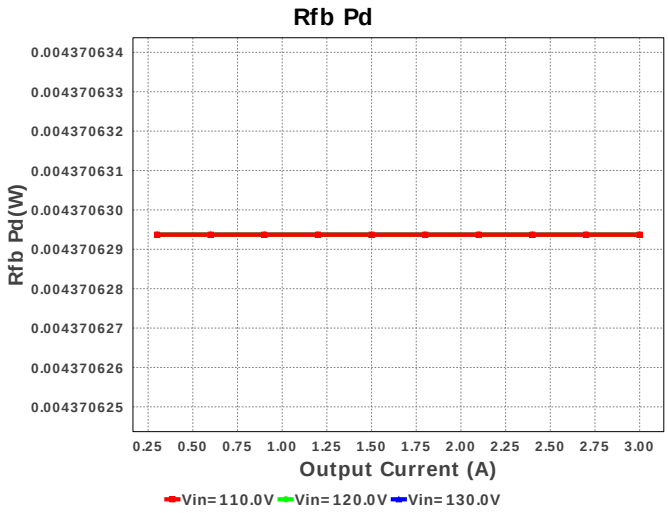


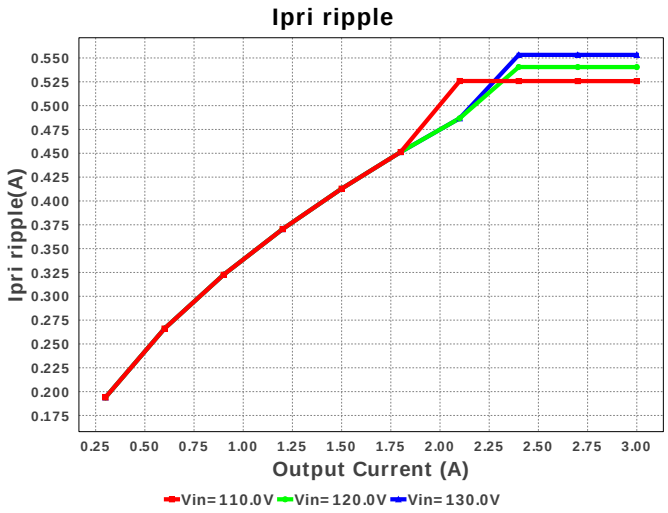


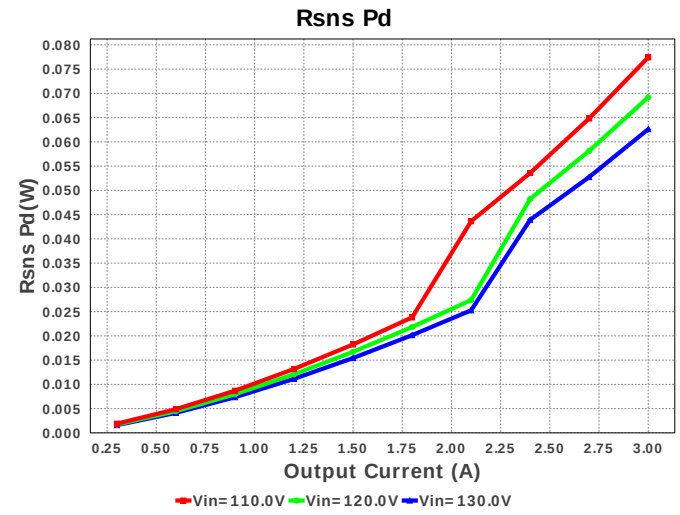


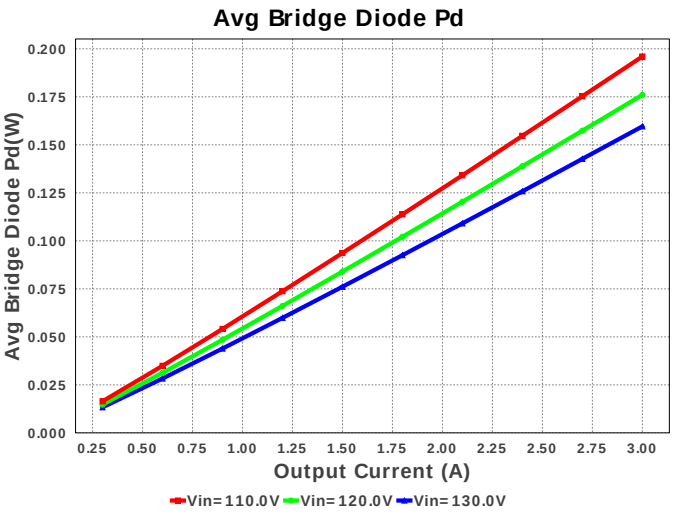


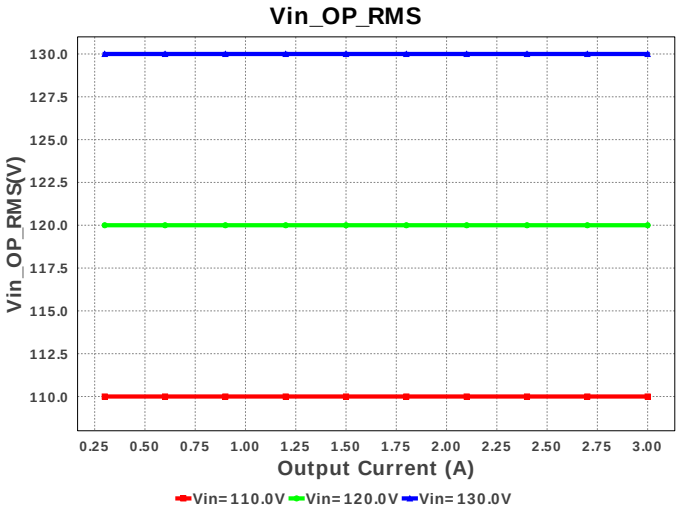


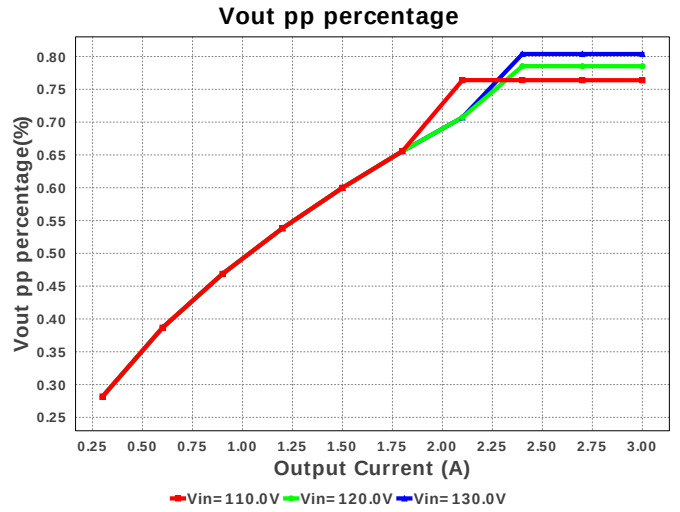


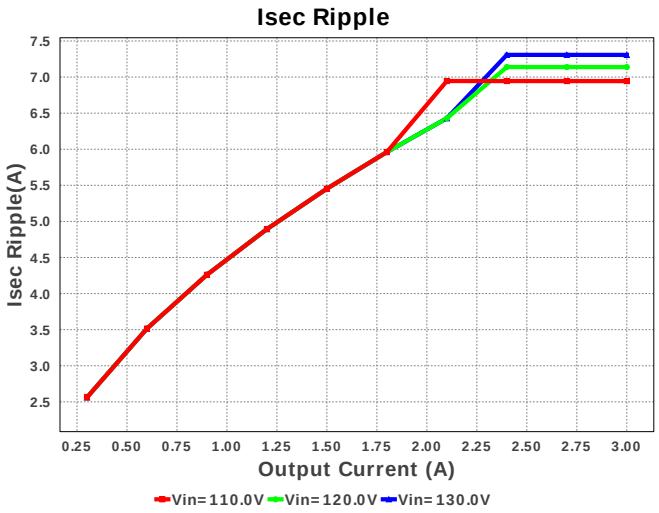


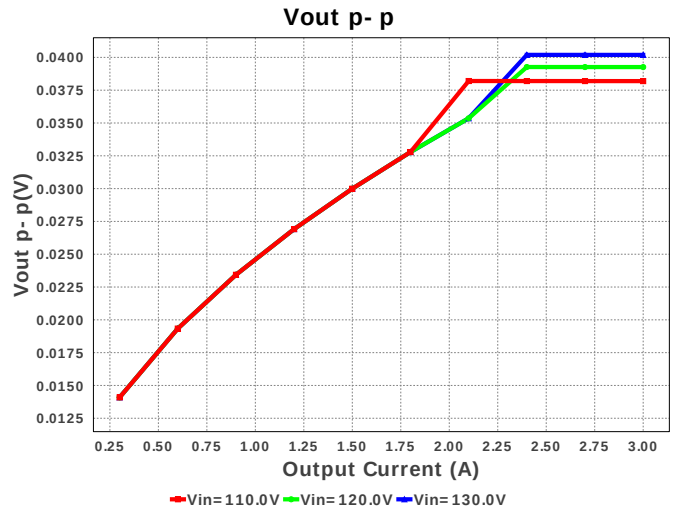


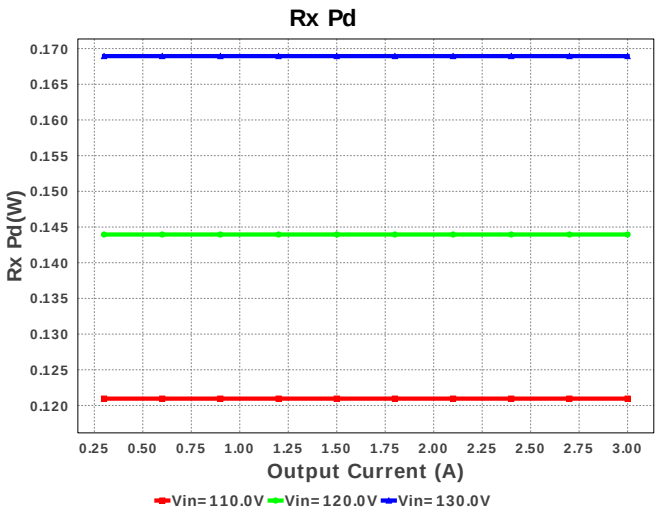


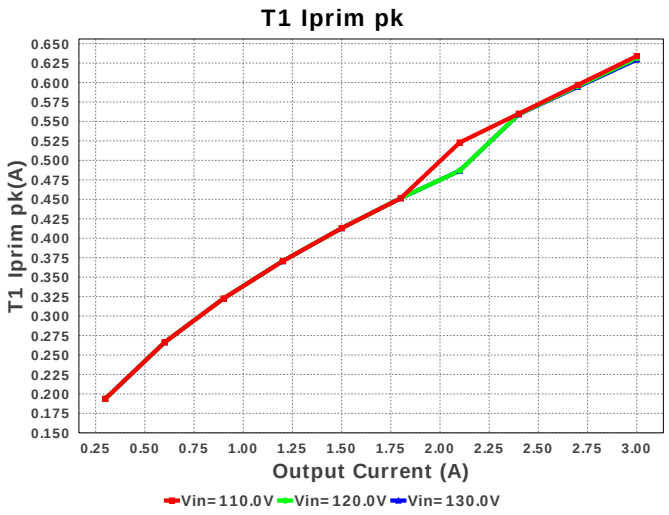












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	2.756 A	Current	Output capacitor1 RMS ripple current
2.	Iin rms	162.47 mA	Current	RMS Input Current
3.	Iout_DCM	1.929 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	151.477 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	525.706 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	141.665 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	6.944 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	256.15 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	633.945 mA	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	4.074 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	8.374 A	Current	Transformer Secondary1 Peak Current
12.	AC Frequency	60.0 Hz	General	Input AC frequency
13.	BOM Count	54	General	Total Design BOM count
14.	Daux trr	0.0 ns	General	Auxiliary Diode Reverse Recovery Time
15.	Dsec Vf	670.0 mV	General	Effective Forward Voltage Drop at the Operating Current
16.	Dsec trr	19.64 ns	General	Output Diode Reverse Recovery Time
17.	Dsec2 Vf	670.0 mV	General	Effective Forward Voltage Drop at the Operating Current
18.	Dsnub trr	0.0 ns	General	Snubber Diode Reverse Recovery Time
19.	FootPrint	2.36 k mm^2	General	Total Foot Print Area of BOM components
20.	Frequency	100.0 kHz	General	Switching frequency
21.	Mode	CCM	General	Conduction Mode
22.	Pout	15.0 W	General	Total output power
23.	Power Factor	1.0	General	Assumed Power Factor for the Application
24.	Tdead	0.0 ns	General	Approximate Dead Time of the Regulator
25.	Toff	6.12 us	General	Approximate Converter Off Time
26.	Ton Act	4.082 us	General	Approximate Converter On Time
27.	Total BOM	$0.0	General	Total BOM Cost
28.	Tsw	10.0 us	General	Switching Time Period
29.	Vaux	15.033 V	General	Auxiliary Voltage
30.	Vsnub	191.412 V	General	Voltage Across the Snubber
31.	Vout Actual	4.995 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
32.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
33.	Duty Cycle	40.819 %	Op_point	Duty cycle
34.	Efficiency	83.93 %	Op_point	Steady state efficiency
35.	IC Tj	33.569 degC	Op_point	IC junction temperature
36.	ICThetaJA	107.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
37.	IOUT_OP	3.0 A	Op_point	Iout operating point
38.	M1 TjOP	35.908 degC	Op_point	M1 MOSFET junction temperature
39.	Peak Rectified Vin	155.562 V	Op_point	Peak voltage seen at rectified input
40.	Vin_OP_RMS	110.0 V	Op_point	AC Input RMS Voltage
41.	Vout p-p	38.192 mV	Op_point	Peak-to-peak output ripple voltage
42.	Avg Bridge Diode Pd	195.989 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
43.	Cbulk Pd	501.831 µW	Power	Bulk capacitor power dissipation
44.	Cout1 Pd	41.784 mW	Power	Output capacitor1 power dissipation
45.	Cx Pd	0.0 W	Power	X-cap Power Dissipation
46.	Cy Pd	187.5 pW	Power	Y-caps Power Dissipation
47.	Dsec Pd	1.005 W	Power	Secondary Diode Power Dissipation
48.	Dsec2 Pd	1.005 W	Power	Secondary Diode Power Dissipation
49.	IC Pd	33.203 mW	Power	IC power dissipation
50.	L1 Pd	1.502 mW	Power	Power Dissipation in the Inductor

#	Name	Value	Category	Description
51.	M1 Pd	71.185 mW	Power	M1 MOSFET total power dissipation
52.	Paux	10.958 mW	Power	Power Dissipation in Raux and Daux
53.	Pd Rstartup	373.647 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
54.	Rdrv Pd	12.288 µW	Power	Power Dissipation in Gate Drive Resistor
55.	Rfb Pd	4.371 mW	Power	Rfb Power Dissipation
56.	Rsns Pd	77.423 mW	Power	Current Limit Sense Resistor Power Dissipation
57.	Rx Pd	120.961 mW	Power	Total Power Dissipation in Rx1 and Rx2
58.	Snubber Pd	630.147 mW	Power	Snubber Power Dissipation
59.	T1 Pd	399.635 mW	Power	Estimated Losses in Transformer
60.	Total Pd	2.872 W	Power	Total Power Dissipation
61.	Vout Tolerance	1.478 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
62.	Vout pp percentage	763.835 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	3.0	Maximum Output Current
2.	VinMax	130.0	Maximum input voltage
3.	VinMin	110.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	line_fsw	60.0	Light Output in Lumen
6.	base_pn	UCC3813-4	Base Product Number
7.	source	AC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

1. **UCC3813-4** Product Folder : http://www.ti.com/product/UCC3813%2D4 : contains the data sheet and other resources.