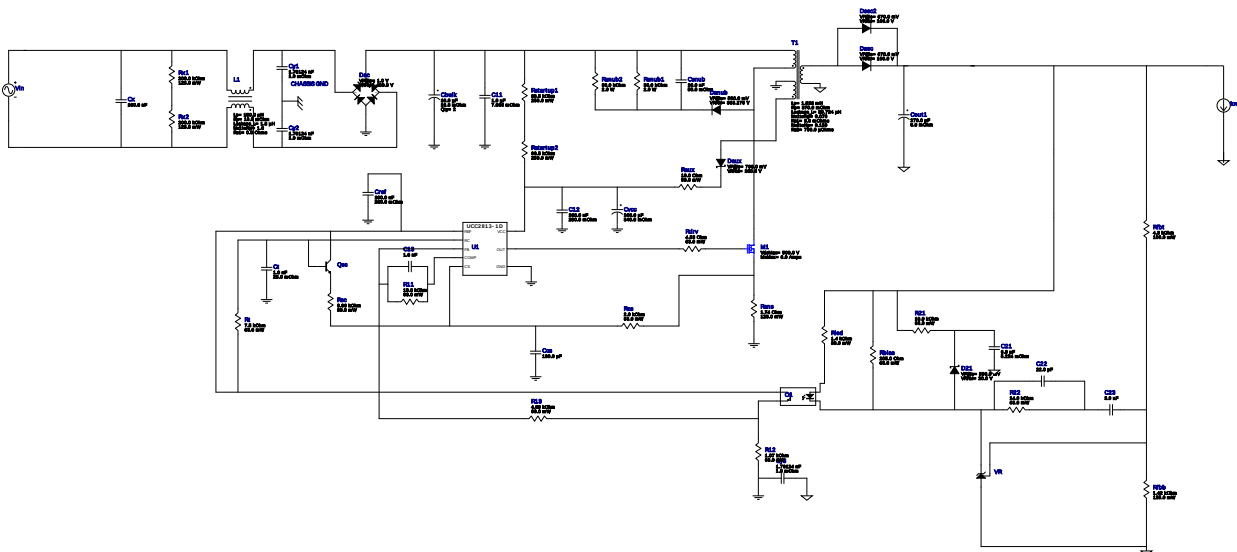


WEBENCH® Design Report

Design : 4796944/6 UCC2813DTR-1
UCC2813DTR-1 110.0V-130.0V to 5.00V @ 2.0A

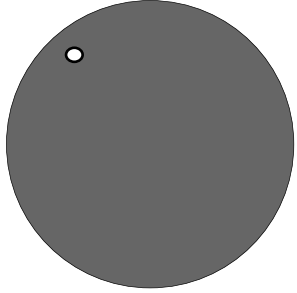


1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.

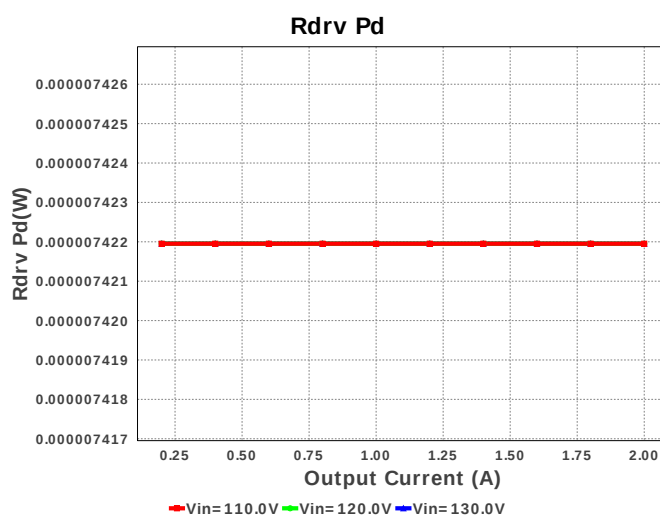
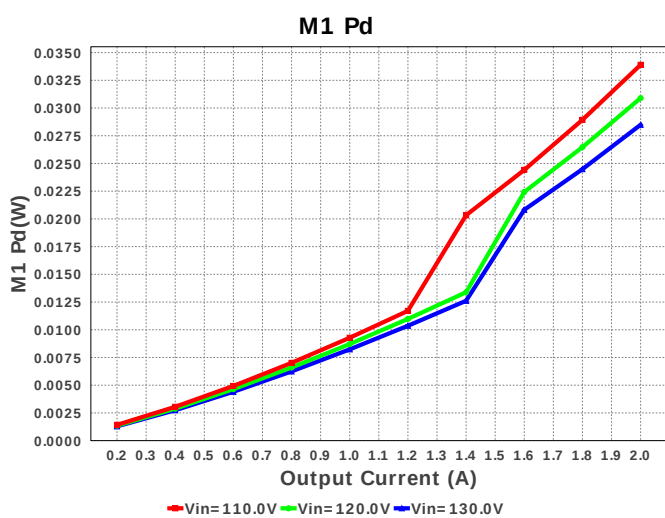
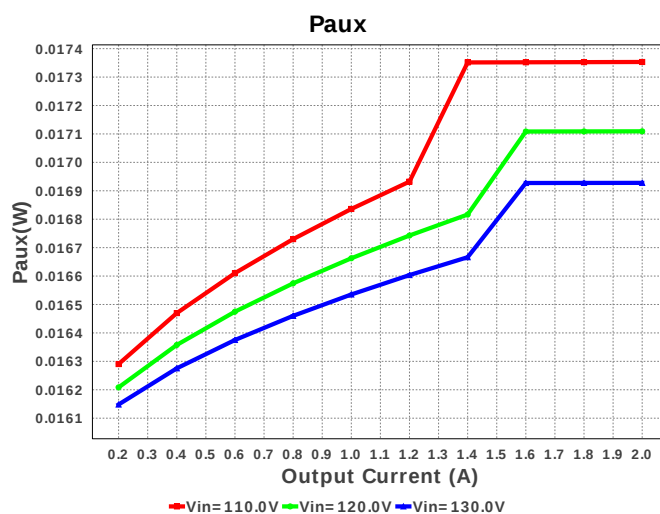
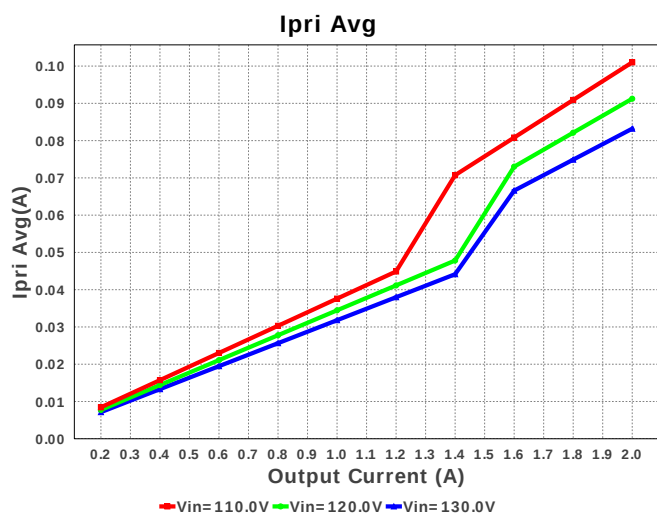
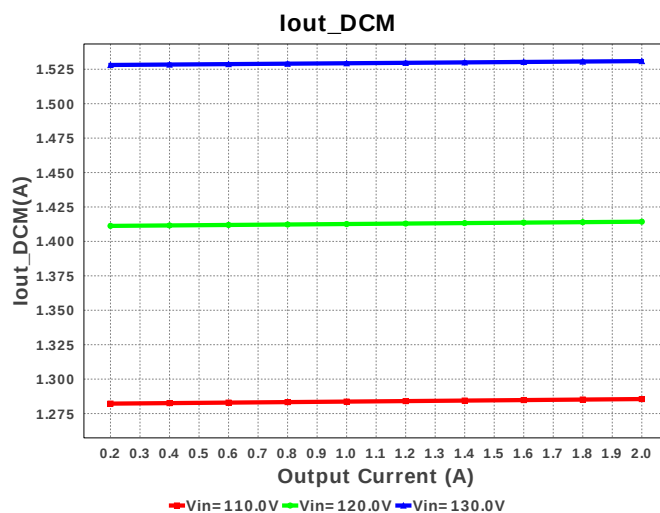
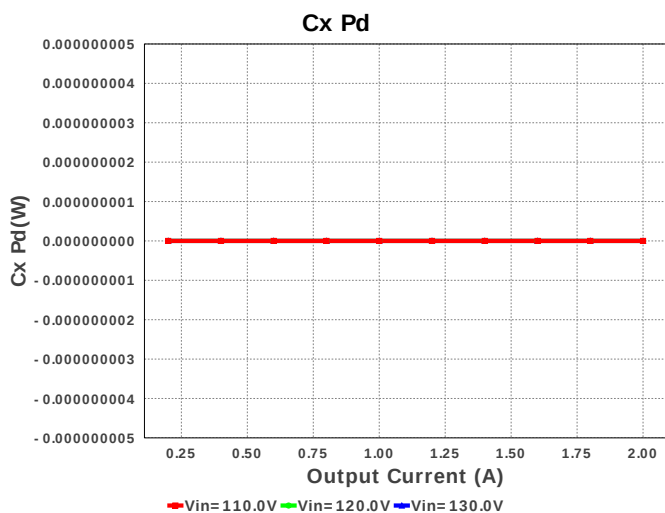
Electrical BOM

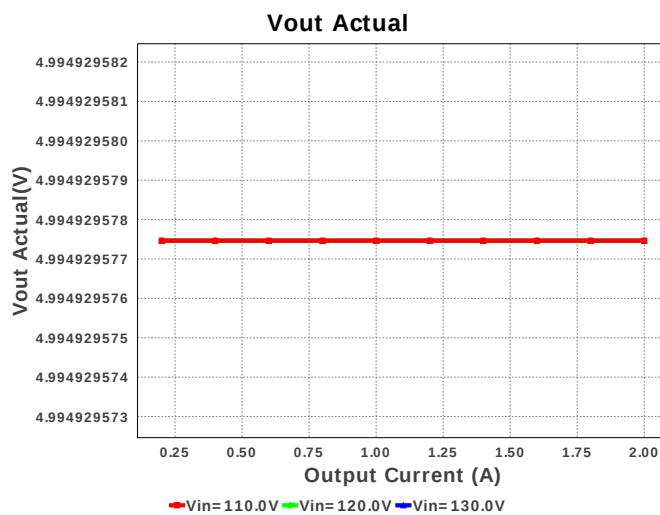
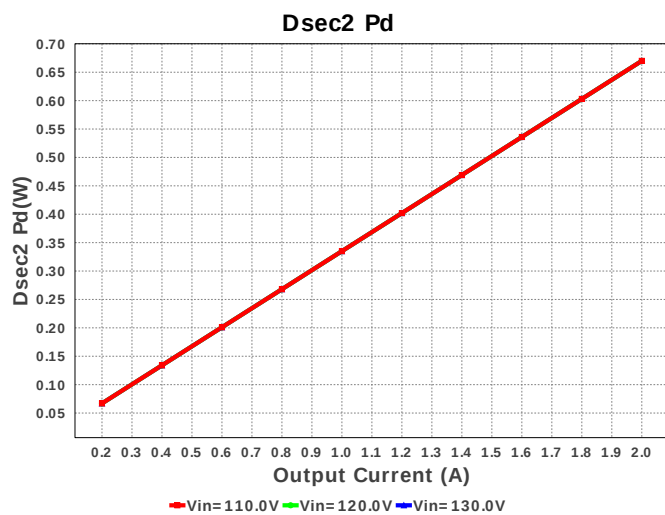
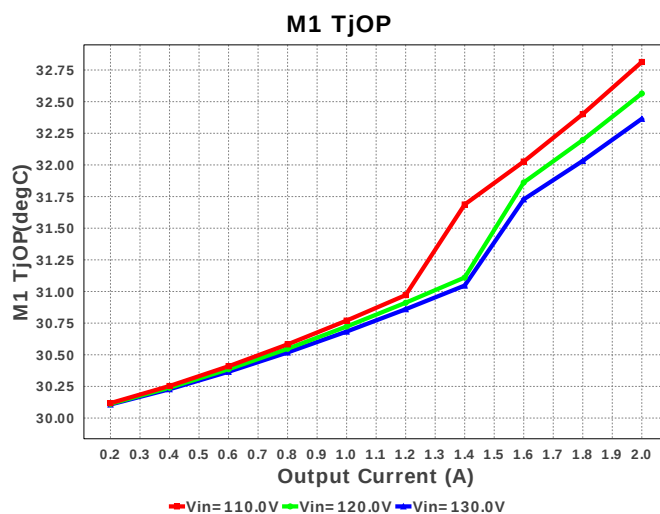
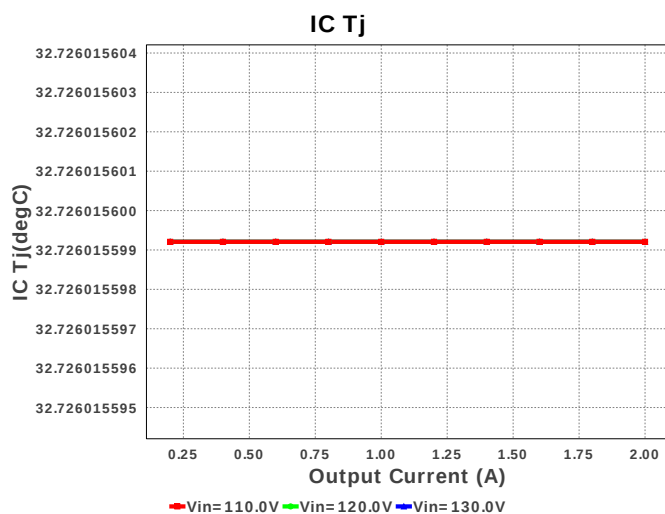
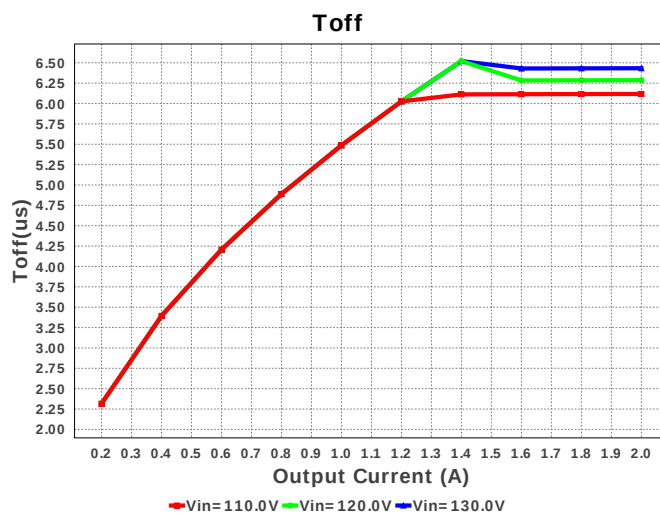
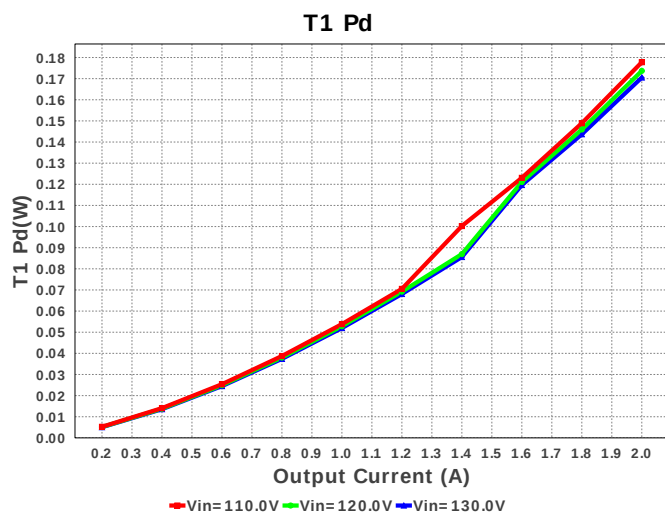
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1.	C11	MuRata	GRM55DR72E105KW01L Series= X7R	Cap= 1.0 uF ESR= 7.086 mOhm VDC= 250.0 V IRMS= 2.0605 A	1	\$0.26	 2220_200 54 mm ²
2.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
3.	C13	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
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 mm ²
5.	C22	Kemet	C0805C220K3GACTU Series= C0G/NP0	Cap= 22.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
6.	C23	Yageo America	CC0805KRX7R9BB392 Series= X7R	Cap= 3.9 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
7.	Cbulk	Rubycon	200RX3010M8X16 Series= ?	Cap= 10.0 uF ESR= 19.8 mOhm VDC= 200.0 V IRMS= 200.0 mA	2	\$0.18	 RX30_800x1600 100 mm ²
8.	Ccs	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²

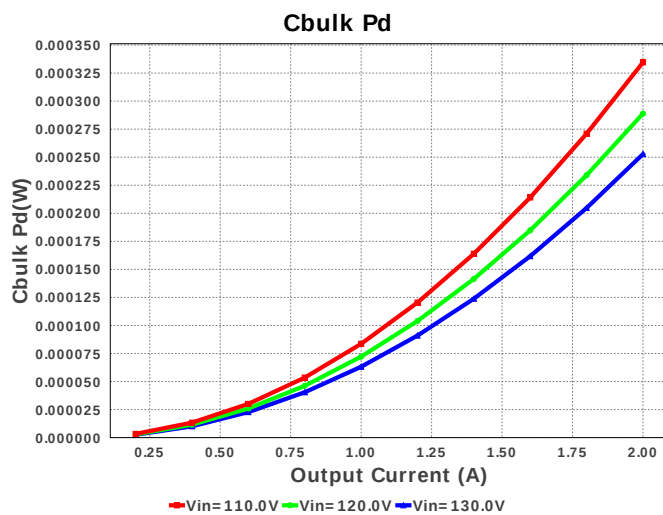
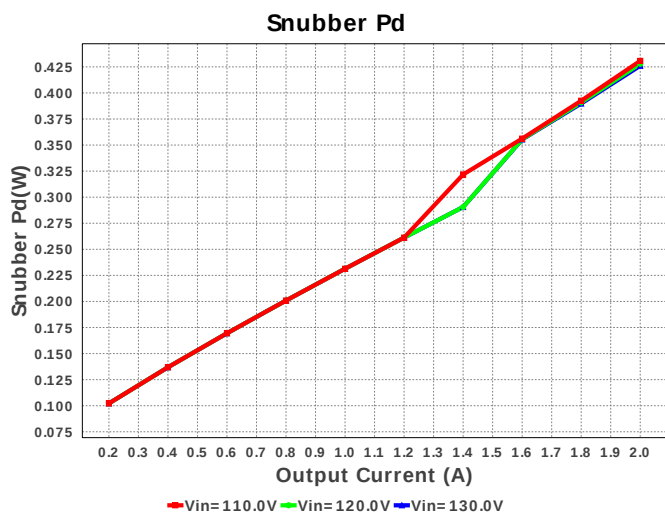
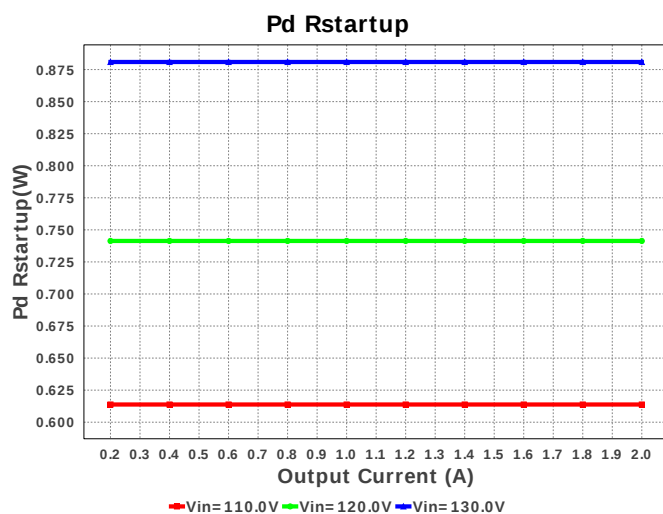
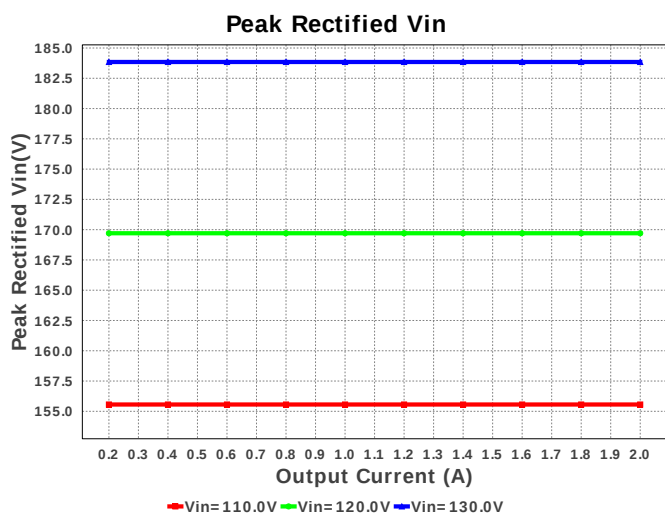
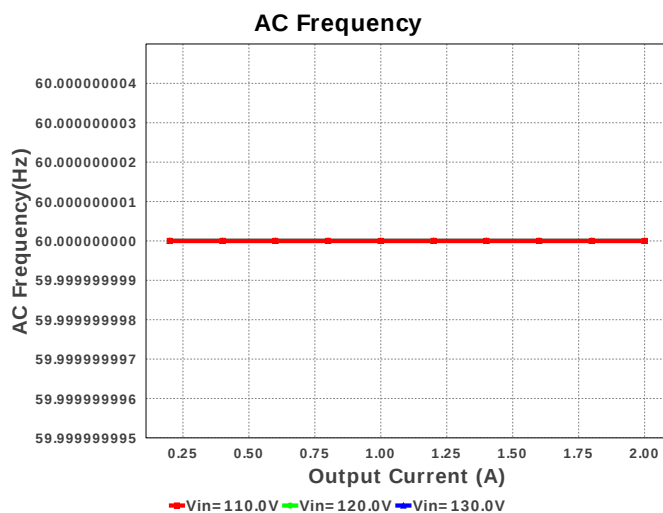
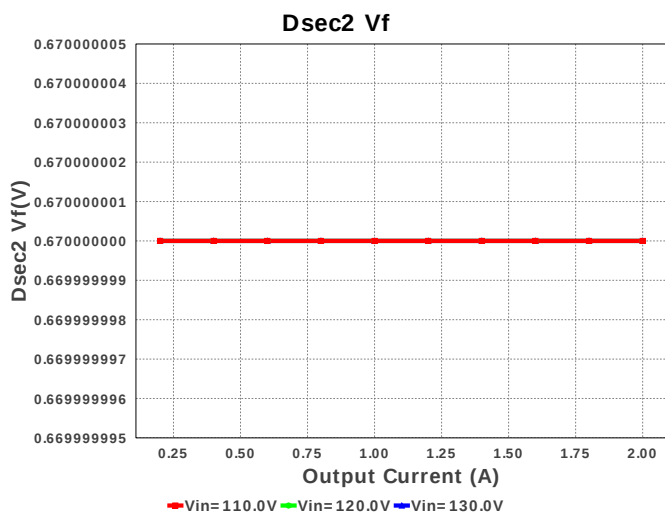
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9.	Cout1	Panasonic	16SVPG270M Series= ?	Cap= 270.0 uF ESR= 8.0 mOhm VDC= 16.0 V IRMS= 5.8 A	1	\$0.70	 CAPSMT_62_C10 74 mm ²
10.	Cref	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
11.	Csnub	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	UUD1E101MCL1GS Series= uD	Cap= 100.0 uF ESR= 340.0 mOhm VDC= 25.0 V IRMS= 280.0 mA	1	\$0.12	 SM_RADIAL_6.3BMM 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	Vishay-Semiconductor	SS12-E3/61T	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMA 37 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.	B1100-13-F	VF@Io= 790.0 mV VRRM= 100.0 V	1	\$0.10	 SMA 37 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= 363.275 V	1	NA	CUSTOM 0 mm ²

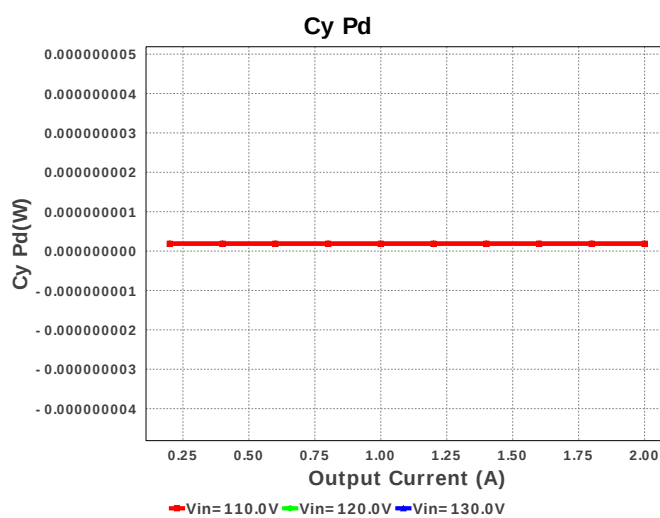
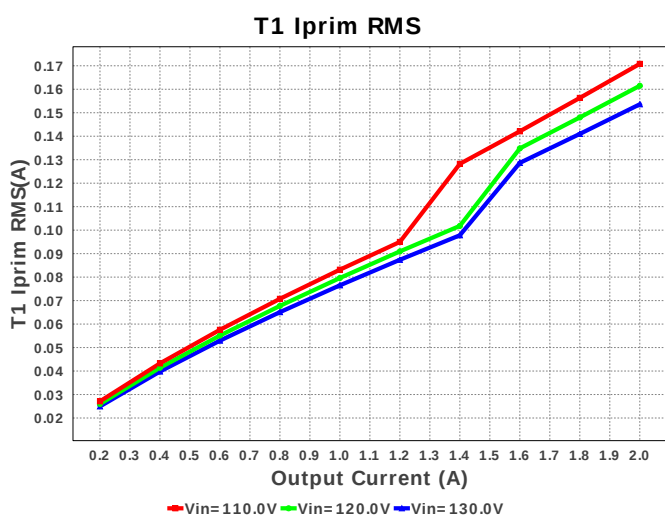
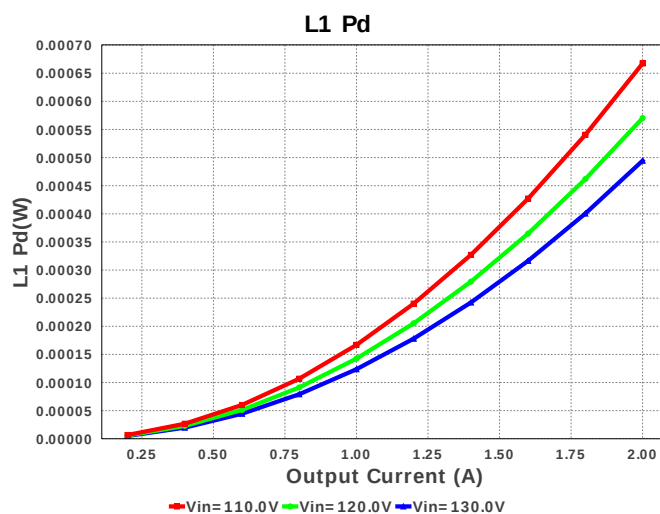
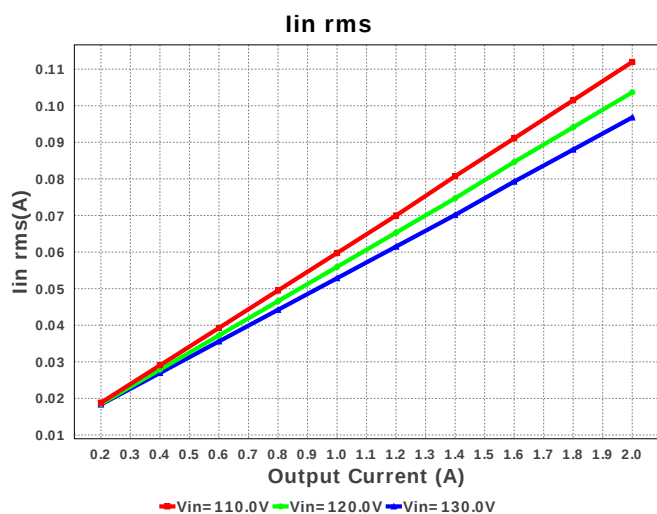
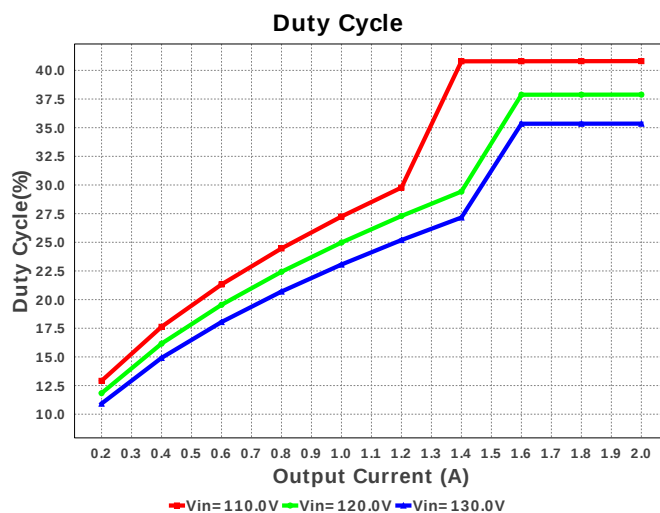
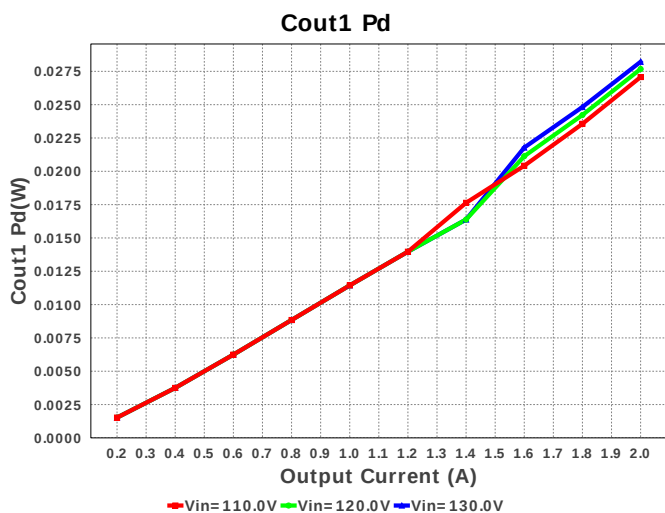
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
24.	L1	API Delevan	CM6296R-154	Lp= 150.0 μ H Rp= 16.0 mOhm Leakage_L= 1.8 μ H Ns1toNp= 1.0 Rs1= 0.0 Ohms	1	\$6.32	 CM6296 833 mm ²
25.	M1	Fairchild Semiconductor	FDD6N50TM	VdsMax= 500.0 V IdsMax= 6.0 Amps	1	\$0.47	 DPAK 102 mm ²
26.	O1	Vishay-Semiconductor	TCMT1109	Optocoupler	1	\$0.21	 SOP-4 44 mm ²
27.	Qsc	STMicroelectronics	2N2222A	Bipolar Transistor	1	NA	 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	CRCW04021K07FKED Series= CRCW..e3	Res= 1.07 kOhm 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	CRCW040214K0FKED Series= CRCW..e3	Res= 14.0 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	CRCW0402205RFBED 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	CRCW04024R53FKED Series= CRCW..e3	Res= 4.53 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.	Rfbb	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	CRCW04021K40FKED Series= CRCW..e3	Res= 1.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
40.	Rsc	Vishay-Dale	CRCW04028K66FKED Series= CRCW..e3	Res= 8.66 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

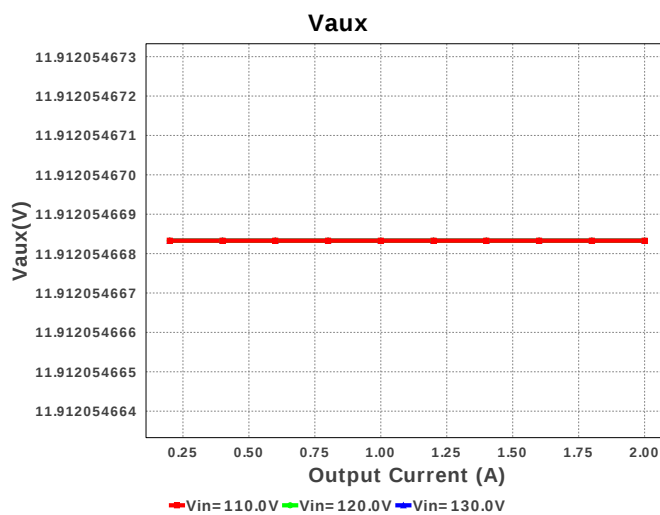
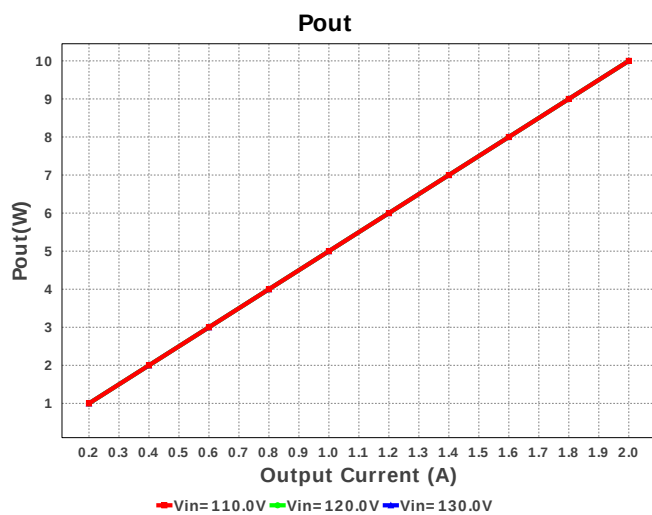
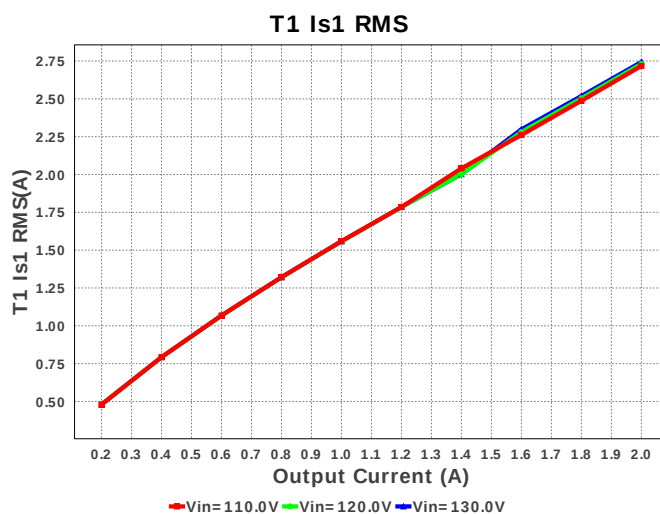
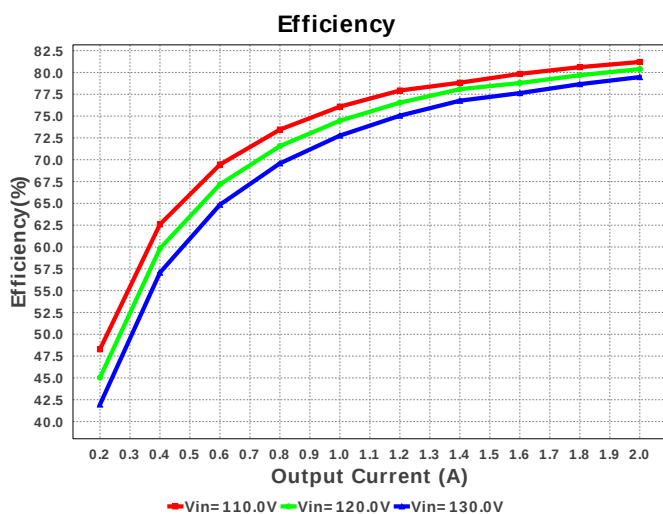
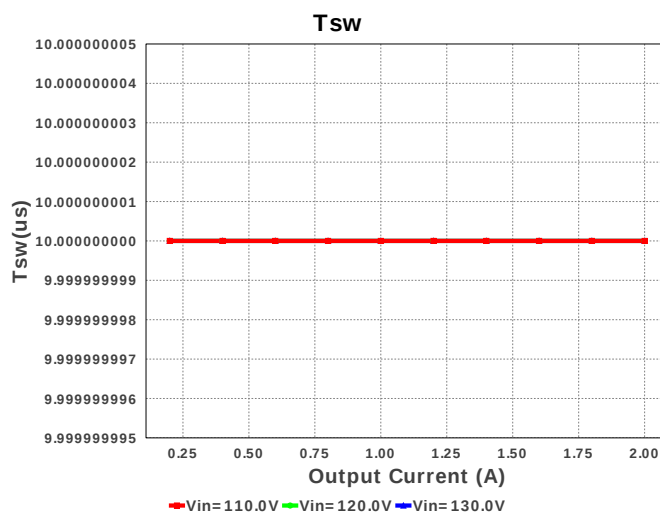
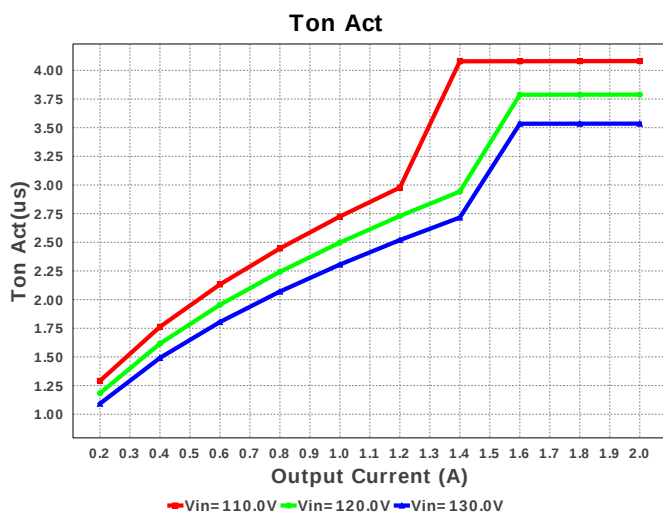
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
41.	Rsns	Vishay-Dale	CRCW08051R74FKEA Series= CRCW..e3	Res= 1.74 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
42.	Rsnub1	TE Connectivity	352139KFT Series= ?	Res= 39.0 kOhm Power= 2.0 W Tolerance= 1.0%	1	\$0.12	 2512 43 mm ²
43.	Rsnub2	TE Connectivity	352139KFT Series= ?	Res= 39.0 kOhm Power= 2.0 W Tolerance= 1.0%	1	\$0.12	 2512 43 mm ²
44.	Rstartup1	Panasonic	ERJ-8ENF6652V Series= ERJ-8E	Res= 66.5 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
45.	Rstartup2	Panasonic	ERJ-8ENF6652V Series= ERJ-8E	Res= 66.5 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= 1.536 mH Rp= 870.0 mOhm Leakage_L= 30.724 μH Ns1toNp= 0.076 Rs1= 8.6 mOhms Ns2toNp= 0.159 Rs2= 700.0 μOhms	1	NA	CUSTOM 0 mm ²
50.	U1	Texas Instruments	UCC2813DTR-1	Switcher	1	\$1.05	 D0008A 57 mm ²
51.	VR	Texas Instruments	LMV431CM5/NOPB	Voltage References	1	\$0.16	 R-PDSO-G3 16 mm ²



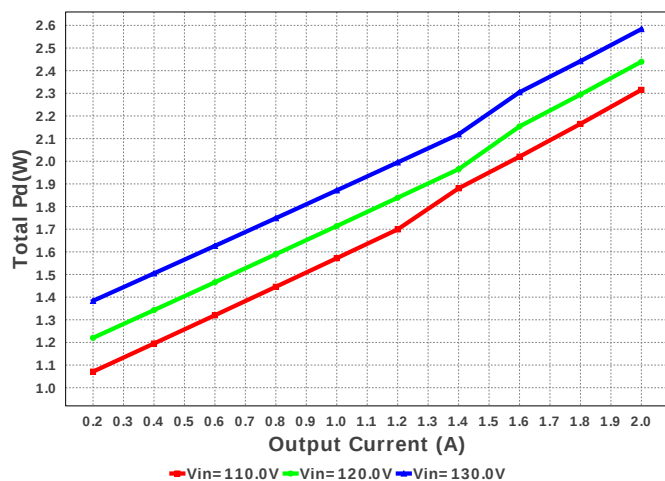




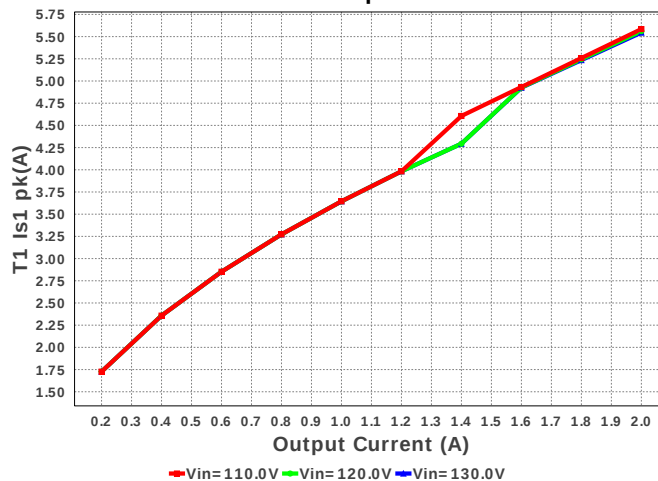




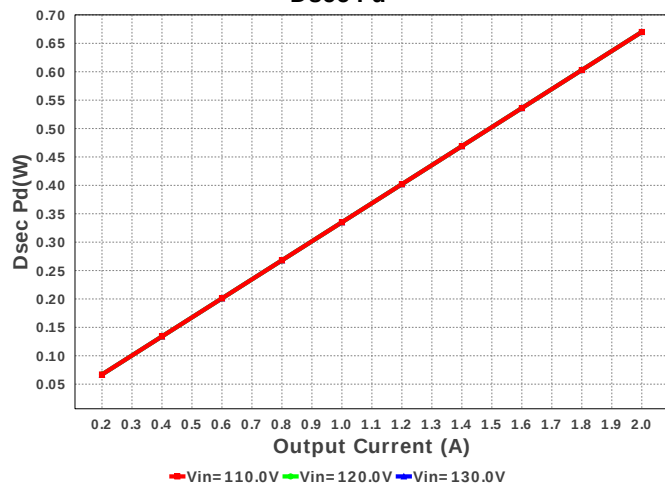
Total Pd



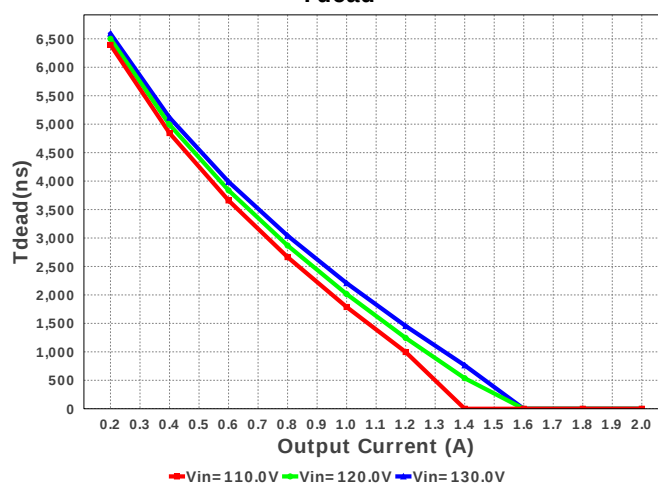
T1 Is1 pk



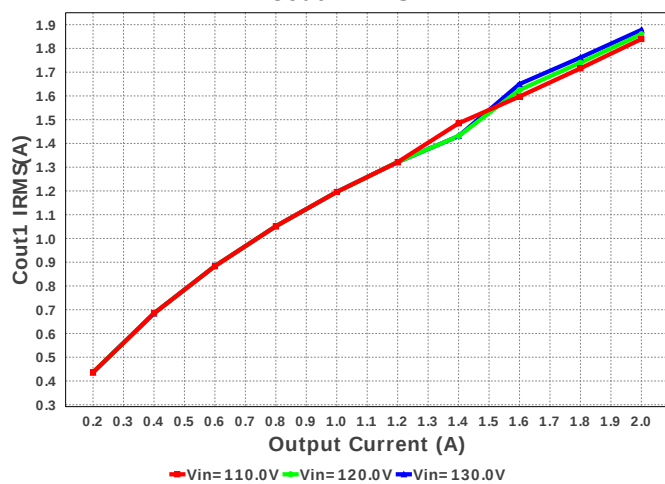
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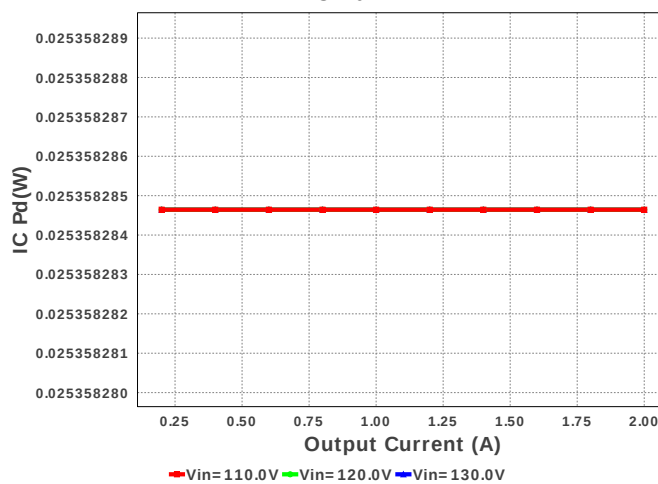
Tdead

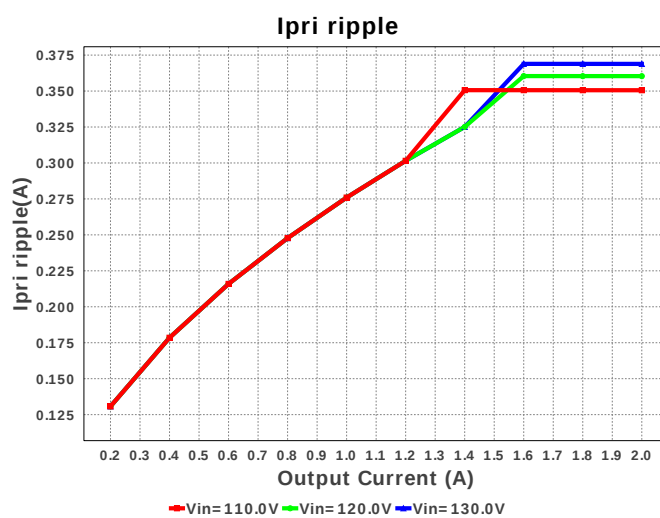
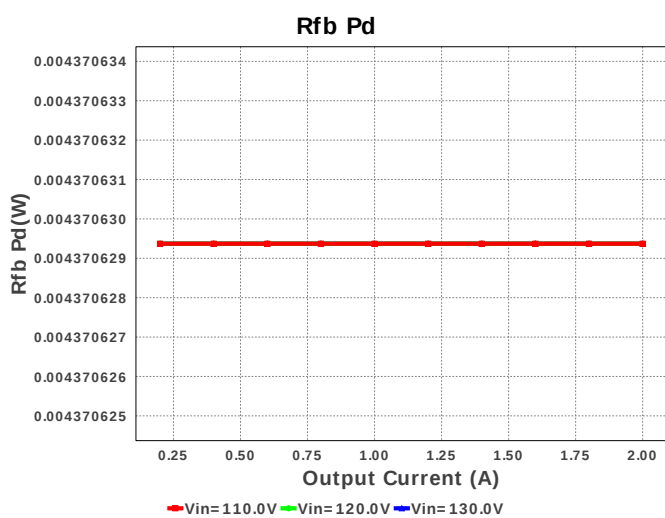
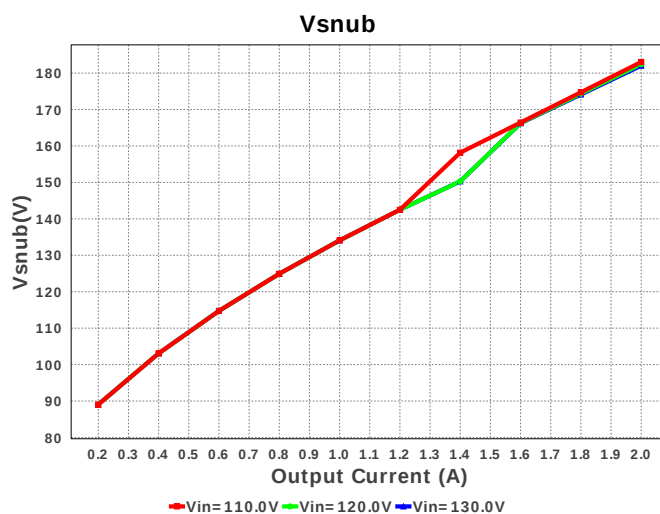
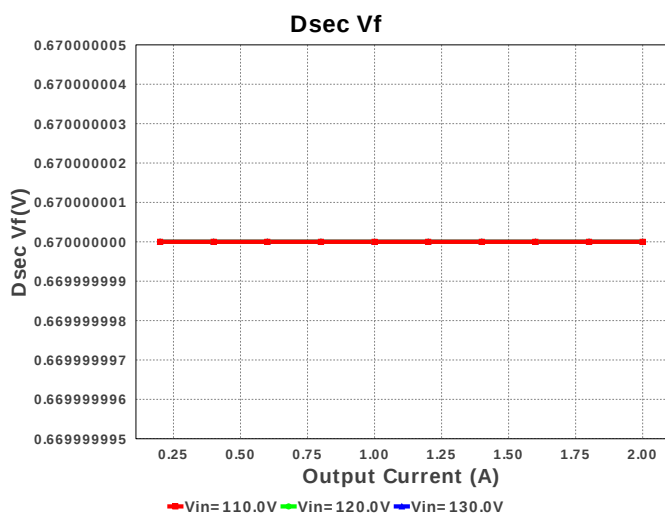
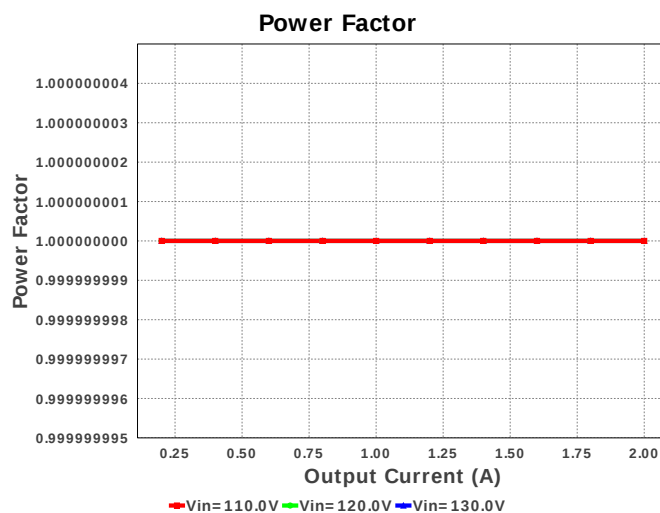
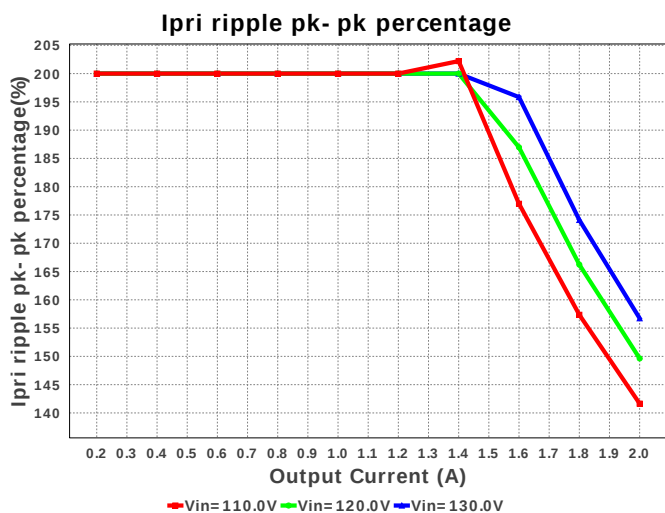


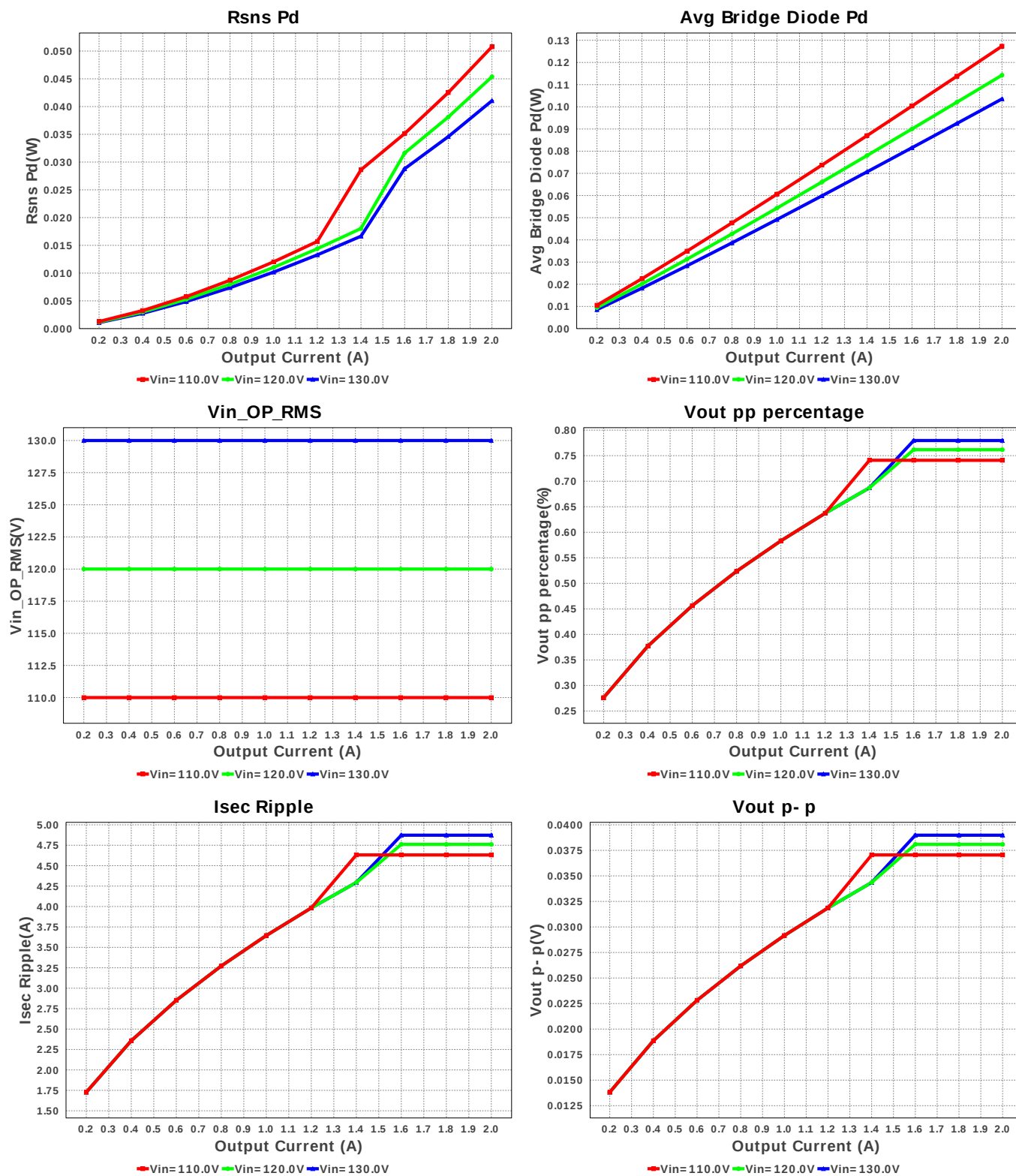
Cout1 IRMS

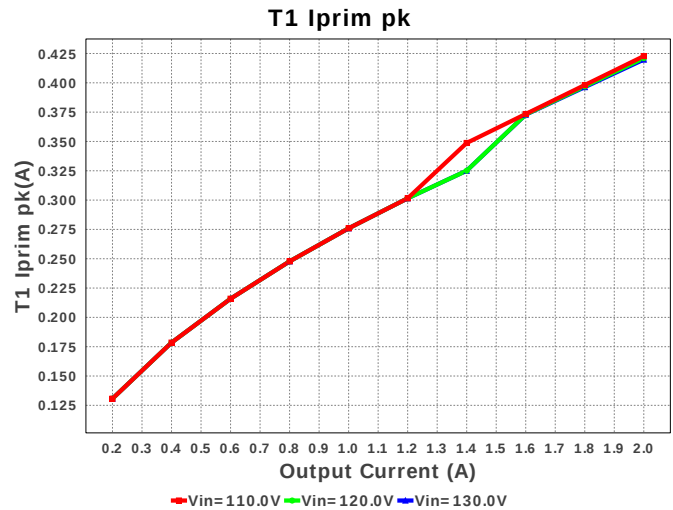
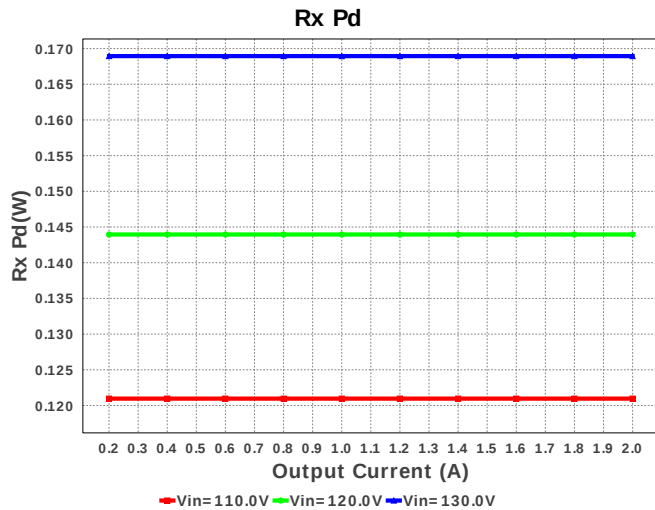


IC Pd









Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	1.84 A	Current	Output capacitor1 RMS ripple current
2.	Iin rms	111.96 mA	Current	RMS Input Current
3.	Iout_DCM	1.286 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	101.001 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	350.565 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	141.646 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	4.631 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	170.812 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	422.776 mA	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	2.717 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	5.585 A	Current	Transformer Secondary1 Peak Current
12.	AC Frequency	60.0 Hz	General	Input AC frequency
13.	BOM Count	52	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	2.276 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	10.0 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	6.118 us	General	Approximate Converter Off Time
26.	Ton Act	4.081 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	11.912 V	General	Auxiliary Voltage
30.	Vsnub	183.05 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	40.81 %	Op_point	Duty cycle
34.	Efficiency	81.2 %	Op_point	Steady state efficiency
35.	IC Tj	32.726 degC	Op_point	IC junction temperature
36.	ICThetaJA	107.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
37.	IOUT_OP	2.0 A	Op_point	Iout operating point
38.	M1 TJOP	32.813 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	37.046 mV	Op_point	Peak-to-peak output ripple voltage
42.	Avg Bridge Diode Pd	127.336 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
43.	Cbulk Pd	334.554 μW	Power	Bulk capacitor power dissipation
44.	Cout1 Pd	27.07 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	670.0 mW	Power	Secondary Diode Power Dissipation
48.	Dsec2 Pd	670.0 mW	Power	Secondary Diode Power Dissipation
49.	IC Pd	25.358 mW	Power	IC power dissipation
50.	L1 Pd	667.353 μW	Power	Power Dissipation in the Inductor

#	Name	Value	Category	Description
51.	M1 Pd	33.896 mW	Power	M1 MOSFET total power dissipation
52.	Paux	17.353 mW	Power	Power Dissipation in Raux and Daux
53.	Pd Rstartup	613.803 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
54.	Rdrv Pd	7.422 μ W	Power	Power Dissipation in Gate Drive Resistor
55.	Rfb Pd	4.371 mW	Power	Rfb Power Dissipation
56.	Rsns Pd	50.767 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	430.752 mW	Power	Snubber Power Dissipation
59.	T1 Pd	177.769 mW	Power	Estimated Losses in Transformer
60.	Total Pd	2.315 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	740.913 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	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	UCC2813-1	Base Product Number
7.	source	AC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

1. **UCC2813-1** Product Folder : <http://www.ti.com/product/UCC2813%2D1> : contains the data sheet and other resources.

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