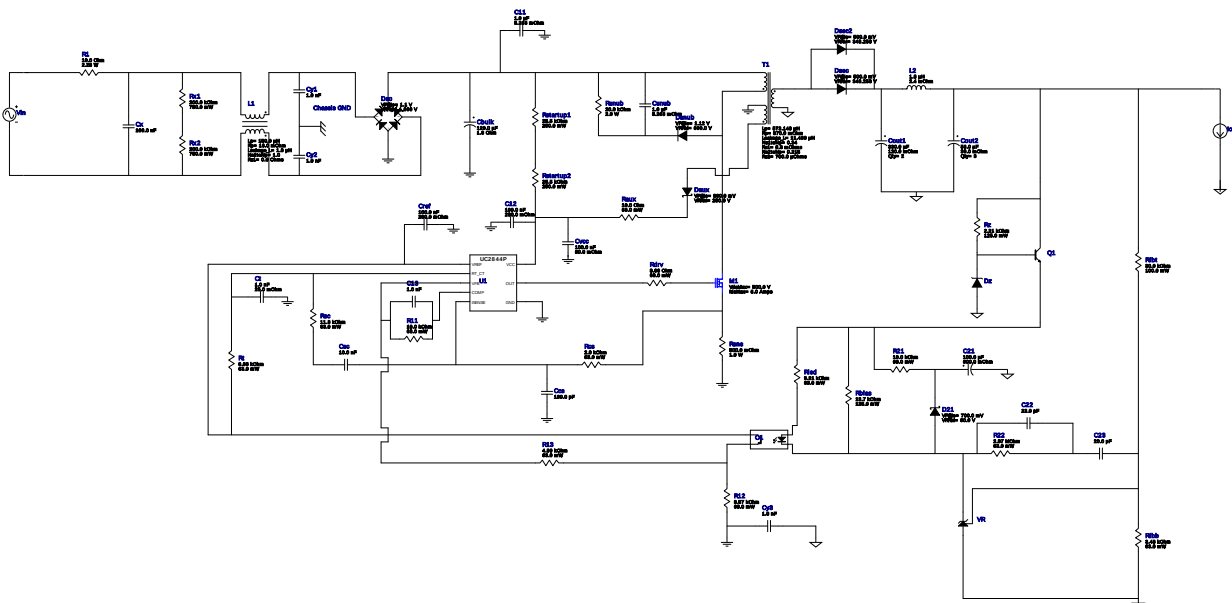


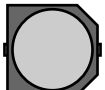
WEBENCH® Design Report

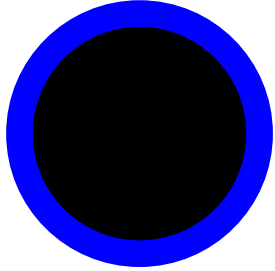
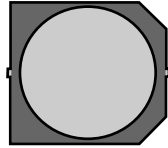
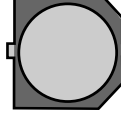
Design : 4372614/23 UC2844N
UC2844N 110.0V-240.0V to 24.00V @ 2.0A

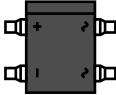
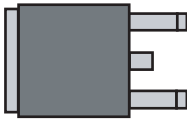
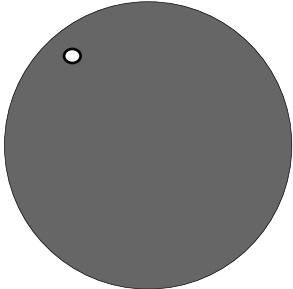


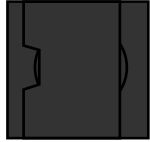
1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.

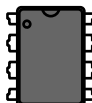
Electrical BOM

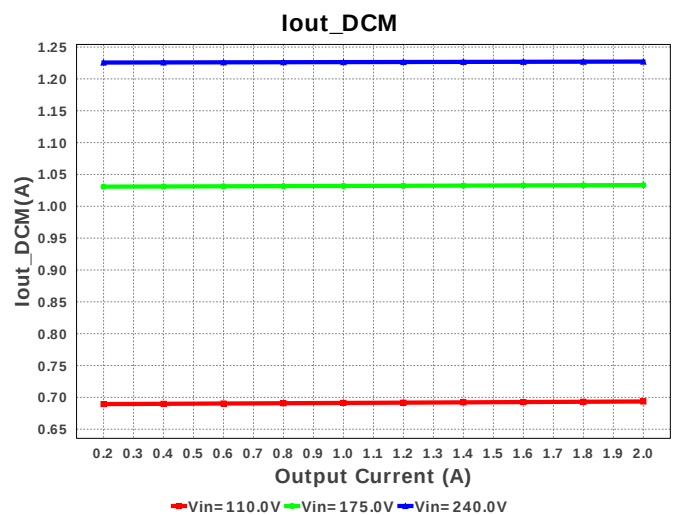
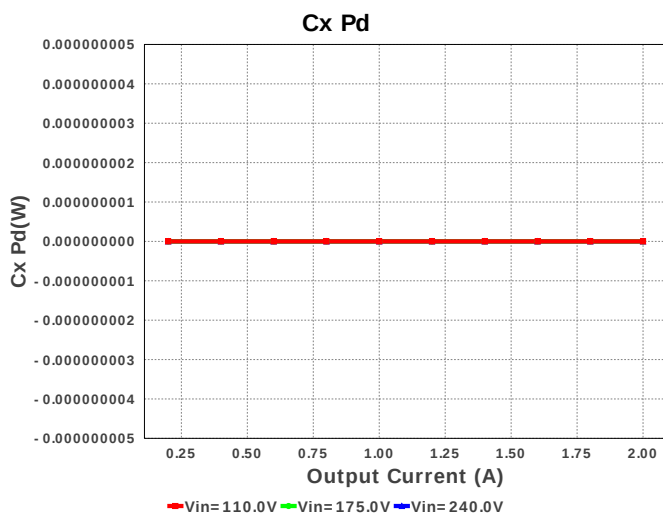
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C11	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	\$1.19	 2220 54 mm ²
2.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
3.	C13	Samsung 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	Chemi-Con	EMVY500ADA101MHA0G Series= MVY	Cap= 100.0 uF ESR= 600.0 mOhm VDC= 50.0 V IRMS= 300.0 mA	1	\$0.21	 CAPSMT_62_HA0 106 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	Samsung Electro-Mechanics	CL21C200JBANNNC Series= C0G/NP0	Cap= 20.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²

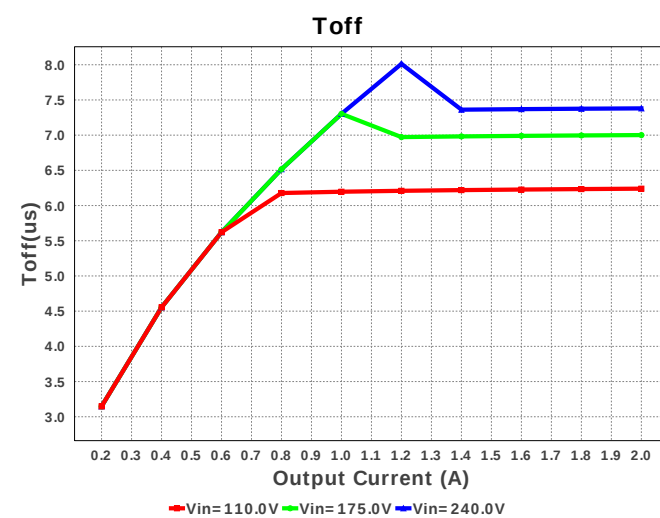
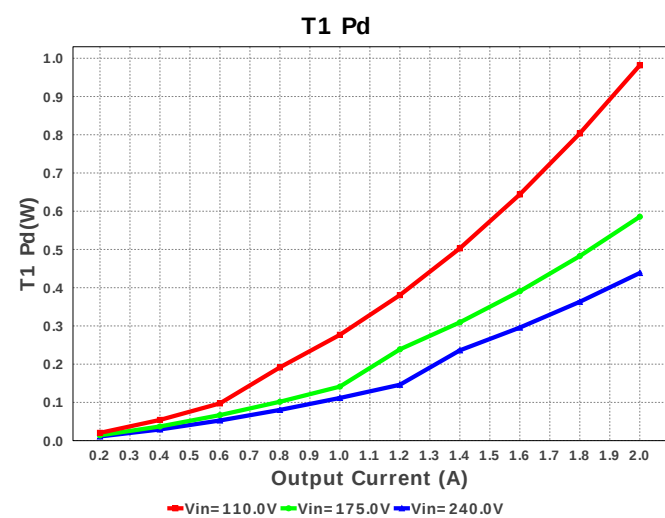
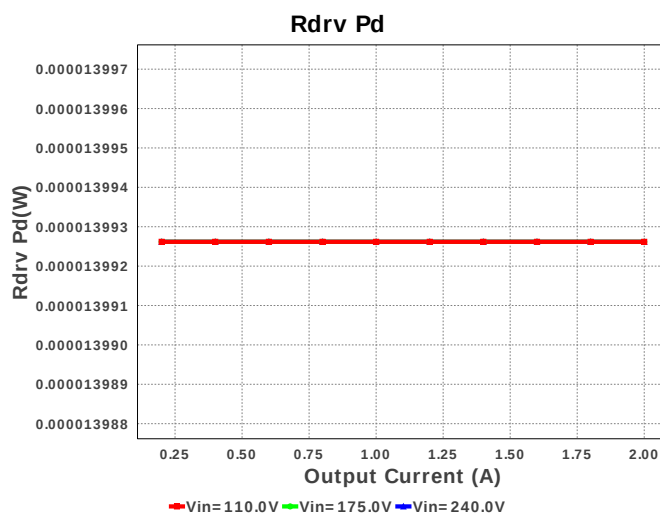
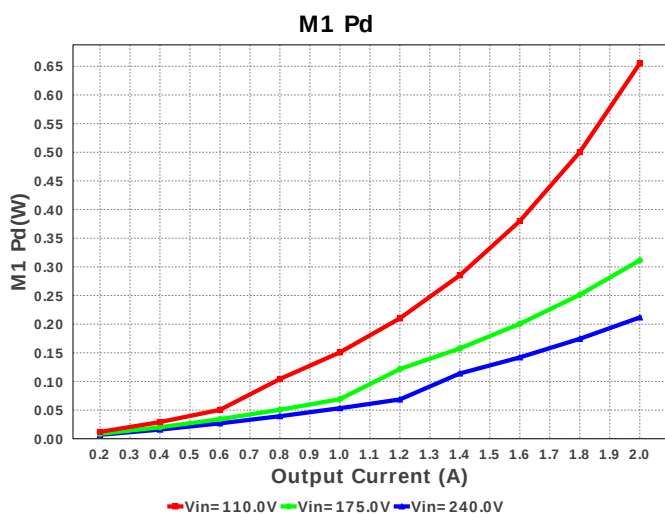
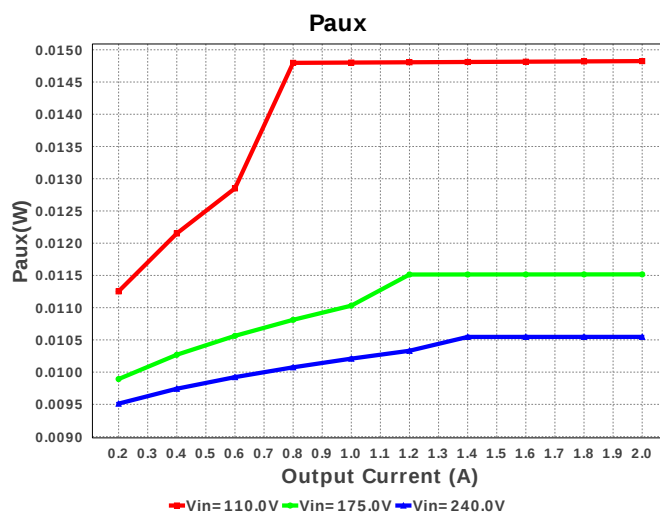
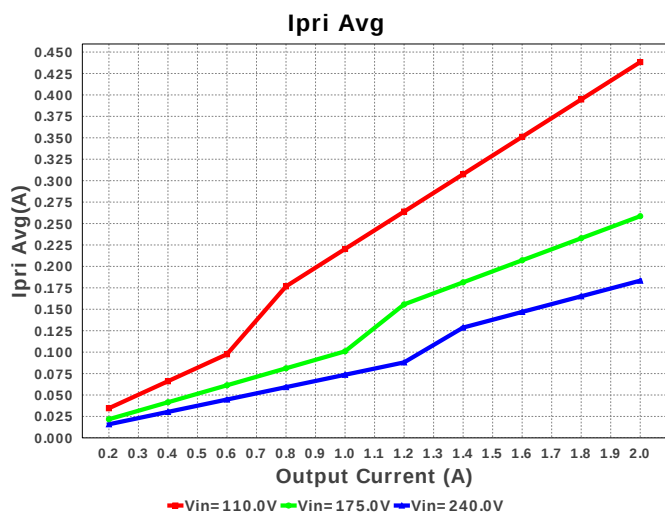
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cbulk	Vishay-Bccomponents	MAL215757121E3 Series= 2239	Cap= 120.0 uF ESR= 1.6 Ohm VDC= 450.0 V IRMS= 1.09 A	1	\$3.90	 157PUM-SI_2500x3000 729 mm ²
8.	Ccs	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
9.	Cout1	Panasonic	EEV-FK1H331Q Series= FK	Cap= 330.0 uF ESR= 120.0 mOhm VDC= 50.0 V IRMS= 900.0 mA	2	\$0.48	 SM_RADIAL_H13 264 mm ²
10.	Cout2	Panasonic	EEHZA1J560P Series= ?	Cap= 56.0 uF ESR= 30.0 mOhm VDC= 63.0 V IRMS= 1.8 A	3	\$1.05	 SM_RADIAL_10BMM 160 mm ²
11.	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
12.	Csc	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
13.	Csnub	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	\$1.19	 2220 54 mm ²
14.	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
15.	Cvcc	MuRata	GRM188R71E104KA01D Series= X7R	Cap= 100.0 nF ESR= 30.0 mOhm VDC= 25.0 V IRMS= 1.51 A	1	\$0.01	 0603 5 mm ²
16.	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
17.	Cy1	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm ²

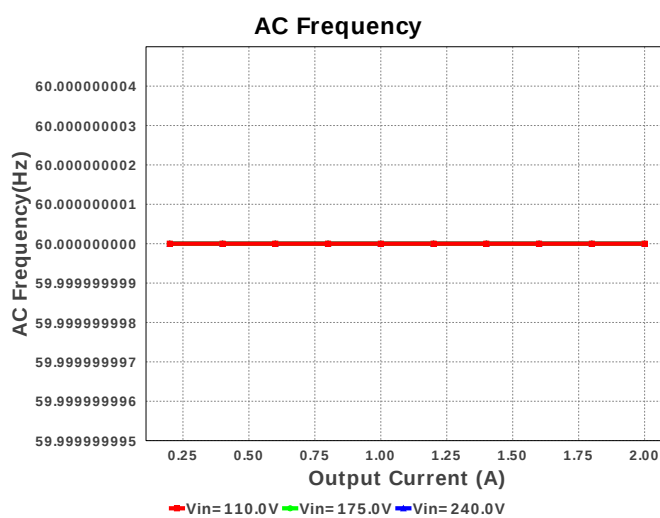
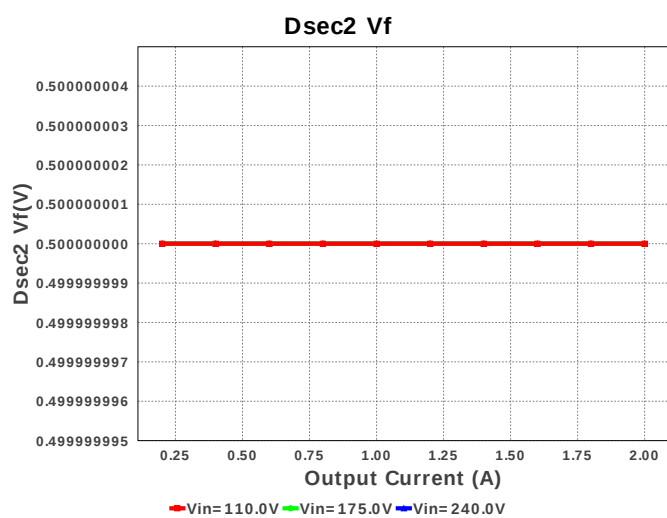
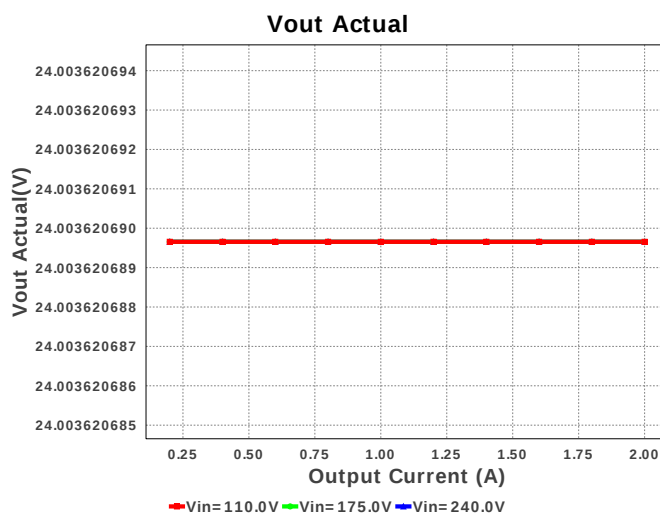
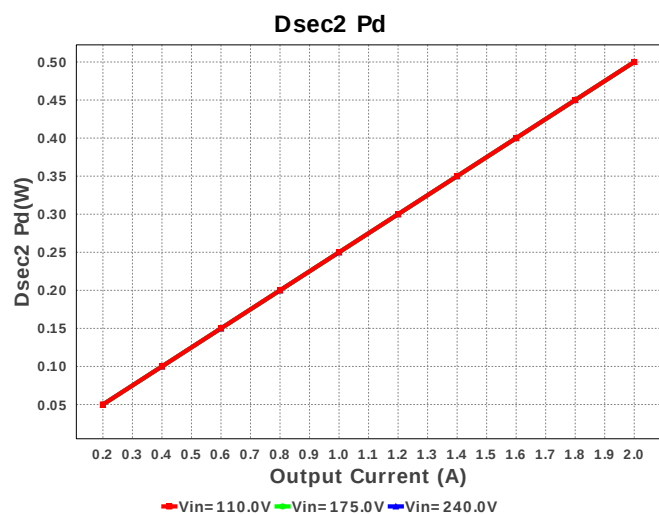
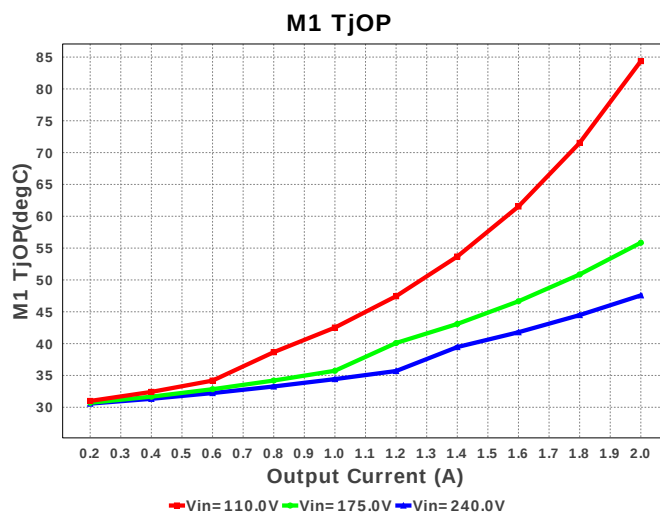
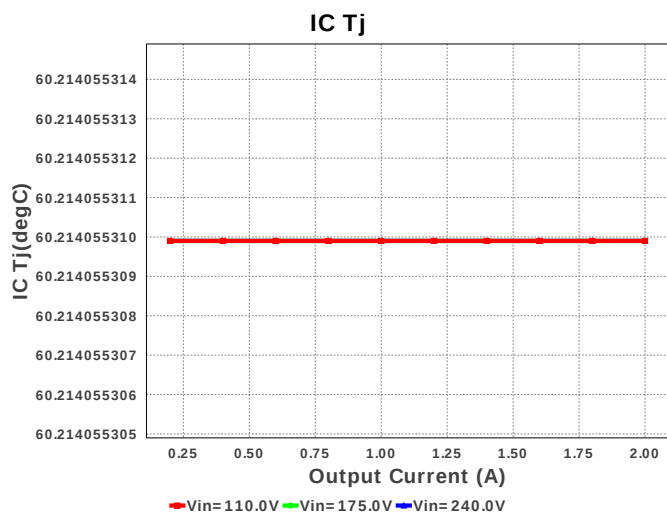
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
18.	Cy2	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm ²
19.	Cy3	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm ²
20.	D21	Diodes Inc.	B260A-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.09	 SMA 37 mm ²
21.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	\$0.24	 DF-S 99 mm ²
22.	Daux	ON Semiconductor	MBRB40250TG	VF@Io= 860.0 mV VRRM= 250.0 V	1	\$0.94	 DDPAK 210 mm ²
23.	Dsec	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 348.258 V	1	NA	CUSTOM 0 mm ²
24.	Dsec2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 348.258 V	1	NA	CUSTOM 0 mm ²
25.	Dsnub	Bourns	CD214C-F3600	VF@Io= 1.12 V VRRM= 600.0 V	1	\$0.18	 SMC 83 mm ²
26.	Dz	Diodes Inc.	MMSZ5250B-7-F	Zener	1	\$0.03	 SOD-123 13 mm ²
27.	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	\$5.95	 CM6296 833 mm ²

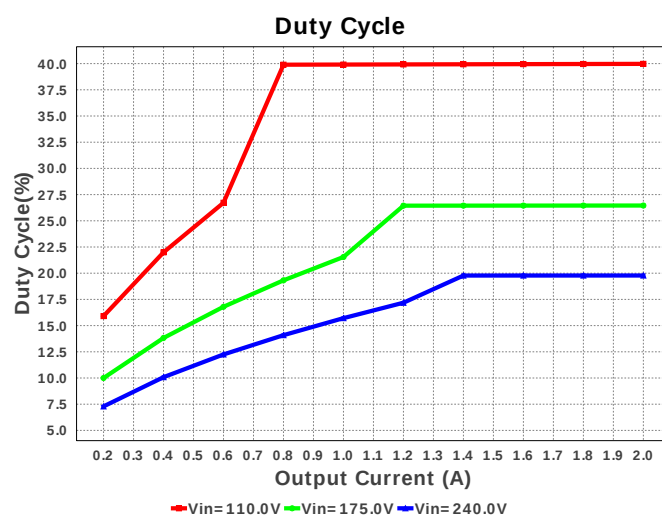
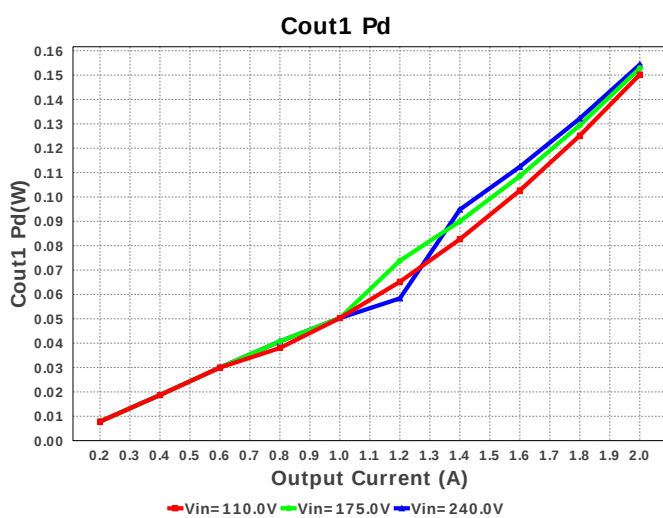
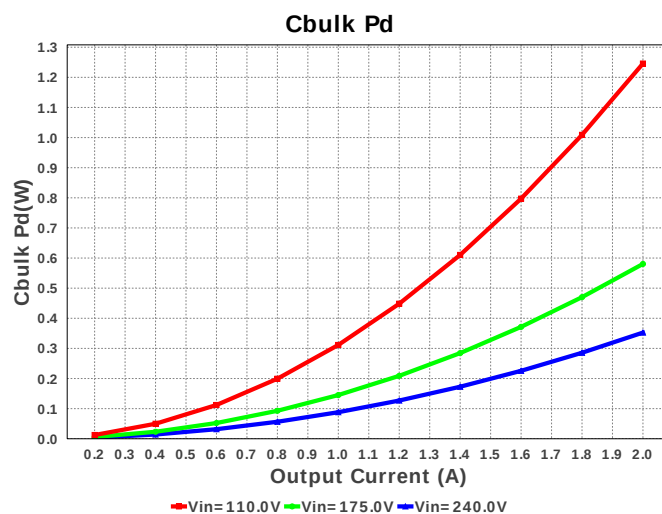
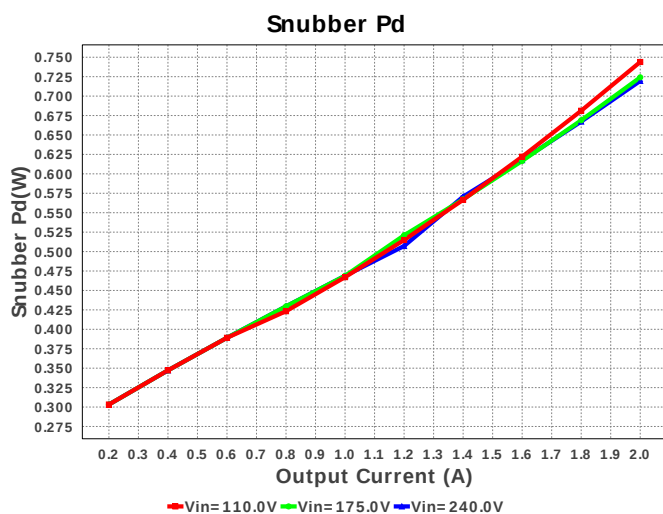
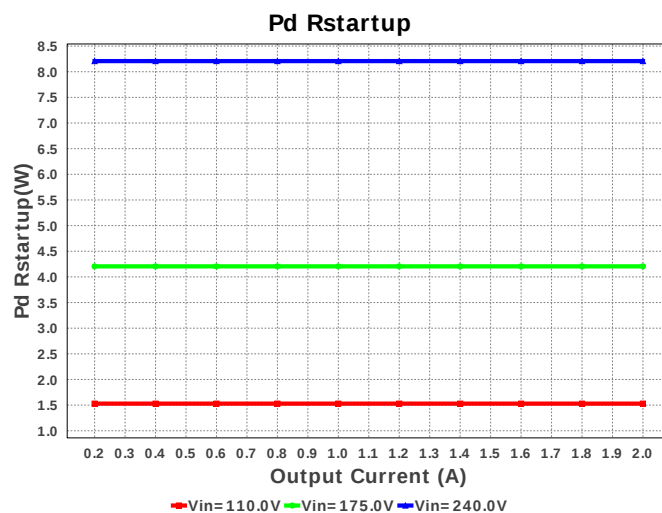
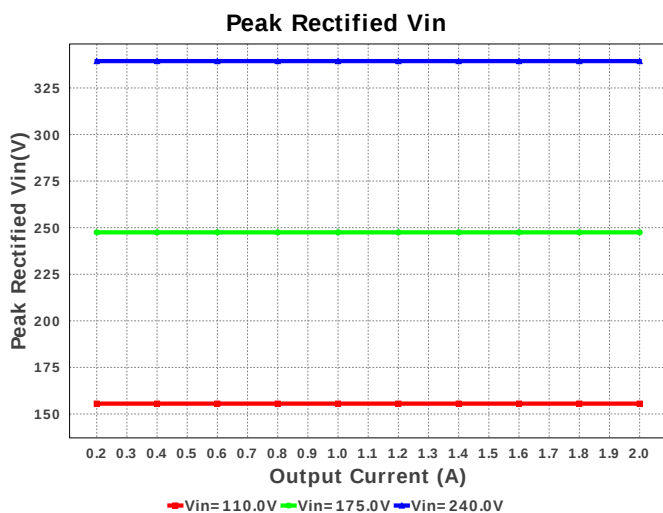
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	L2	Coilcraft	SER1360-182KLB	L= 1.8 μ H DCR= 2.4 mOhm	1	\$0.72	 SER1360 225 mm ²
29.	M1	Fairchild Semiconductor	FDD6N50TM	VdsMax= 500.0 V IdsMax= 6.0 Amps	1	\$0.47	 DPAK 102 mm ²
30.	O1	Vishay-Semiconductor	TCMT1107	Optocoupler	1	\$0.21	 SOP-4 44 mm ²
31.	Q1	ON Semiconductor	BC846BLT1G	Bipolar Transistor	1	\$0.02	 SOT-23 14 mm ²
32.	R1	Vishay-Dale	AC03000001009JACCS Series= F_RES	Res= 10.0 Ohm Power= 2.25 W Tolerance= 5.0%	1	\$0.30	 AC03 158 mm ²
33.	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
34.	R12	Vishay-Dale	CRCW04023K57FKED Series= CRCW..e3	Res= 3.57 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
35.	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
36.	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
37.	R22	Vishay-Dale	CRCW04022M87FKED Series= CRCW..e3	Res= 2.87 MOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
38.	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
39.	Rbias	Panasonic	ERJ-6ENF1372V Series= ERJ-6E	Res= 13.7 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
40.	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
41.	Rdrv	Vishay-Dale	CRCW04028R66FKED Series= CRCW..e3	Res= 8.66 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
42.	Rfbb	Vishay-Dale	CRCW04023K48FKED Series= CRCW..e3	Res= 3.48 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
43.	Rfbt	Yageo America	RC0603FR-0730KL Series= ?	Res= 30.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
44.	Rled	Vishay-Dale	CRCW04029K31FKED Series= CRCW..e3	Res= 9.31 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
45.	Rsc	Vishay-Dale	CRCW040211K3FKED Series= CRCW..e3	Res= 11.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
46.	Rsns	Stackpole Electronics Inc	CSRN2010FKR500 Series= ?	Res= 500.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.10	 2010 32 mm ²

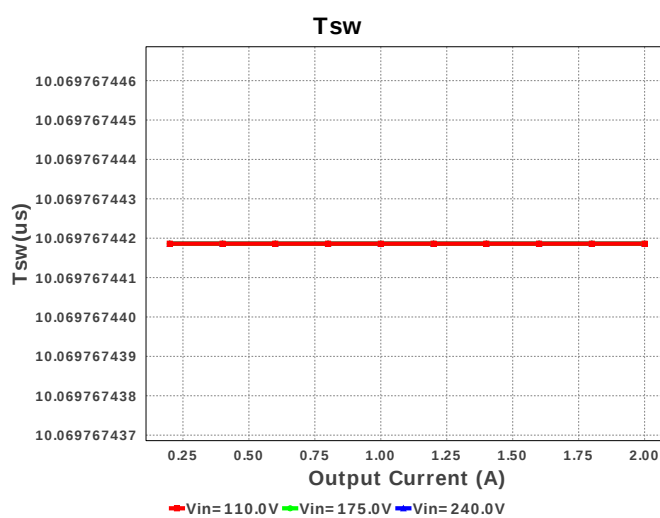
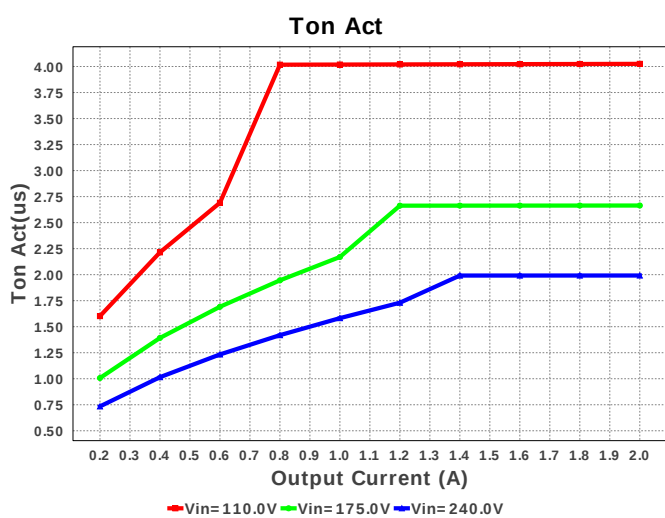
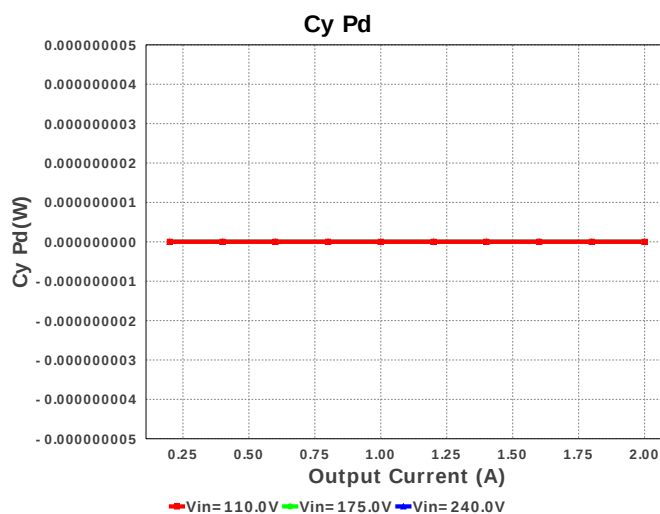
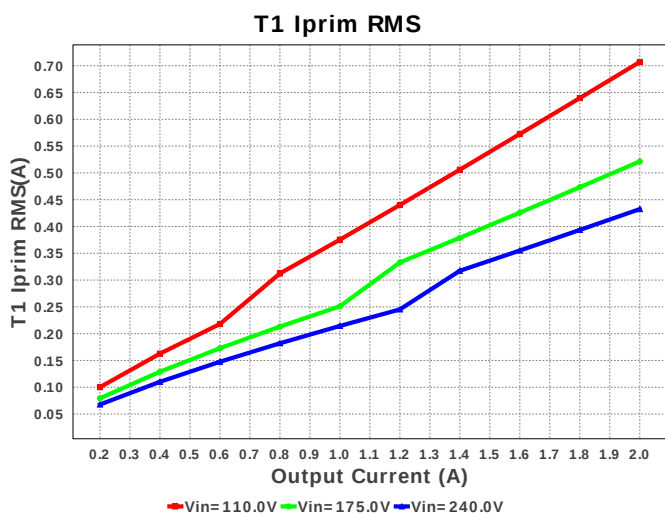
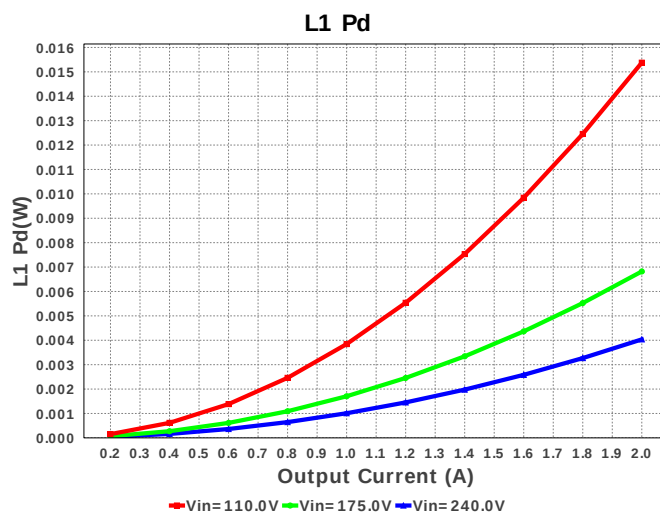
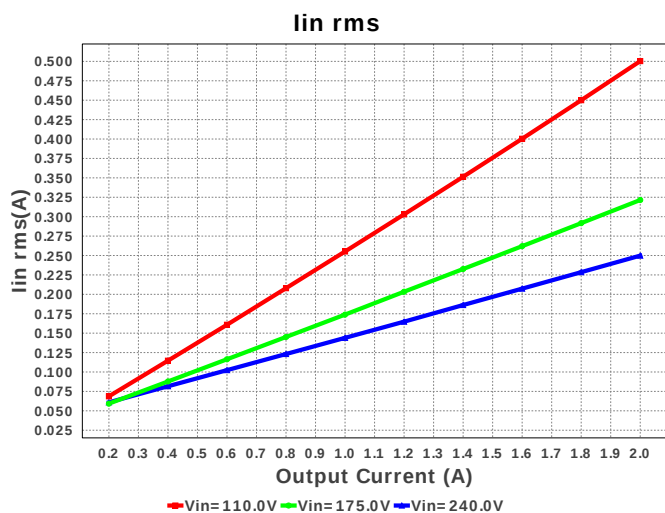
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
47.	Rsnub	Vishay-Bccomponents	PR02000202002JR500 Series= ?	Res= 20.0 kOhm Power= 2.0 W Tolerance= 5.0%	1	\$0.05	PR02 113 mm ²
48.	Rstartup1	Panasonic	ERJ-8ENF2552V Series= ERJ-8E	Res= 25.5 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
49.	Rstartup2	Panasonic	ERJ-8ENF2552V Series= ERJ-8E	Res= 25.5 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
50.	Rt	Vishay-Dale	CRCW04028K66FKED Series= CRCW..e3	Res= 8.66 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
51.	Rx1	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm ²
52.	Rx2	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm ²
53.	Rz	Panasonic	ERJ-6ENF2211V Series= ERJ-6E	Res= 2.21 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
54.	T1	CUSTOM	CUSTOM	Lp= 573.148 µH Rp= 870.0 mOhm Leakage_L= 11.463 µH Ns1toNp= 0.34 Rs1= 8.6 mOhms Ns2toNp= 0.215 Rs2= 700.0 µOhms	1	NA	CUSTOM 0 mm ²
55.	U1	Texas Instruments	UC2844N	Switcher	1	\$0.64	 P0008A 116 mm ²
56.	VR	Texas Instruments	TL431AIDBVR	Voltage References	1	\$0.07	 R-PDSO-G3 16 mm ²

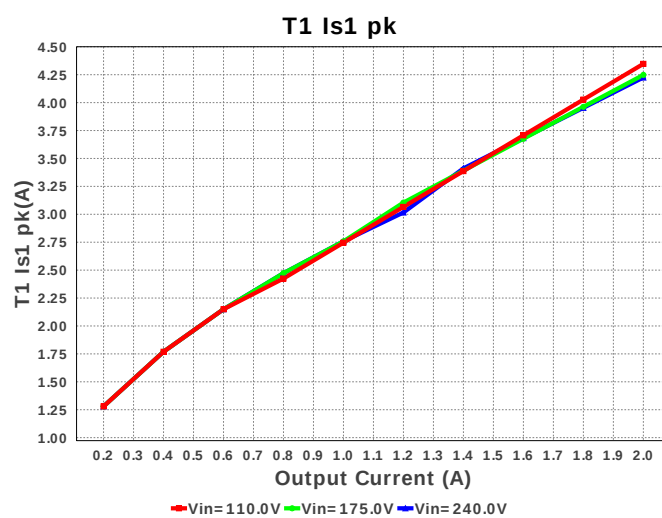
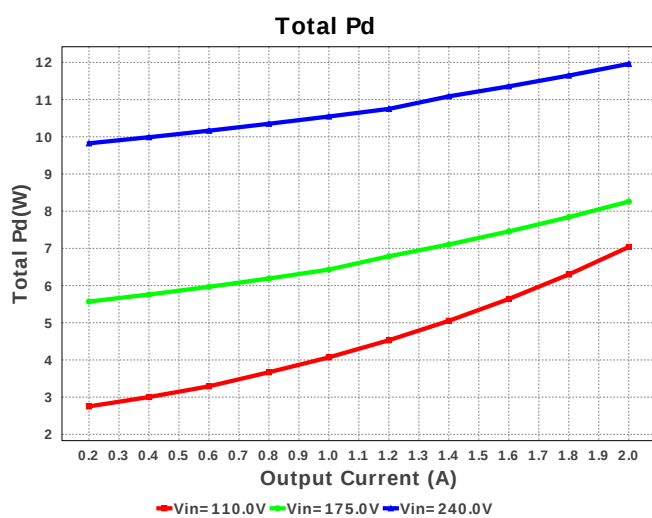
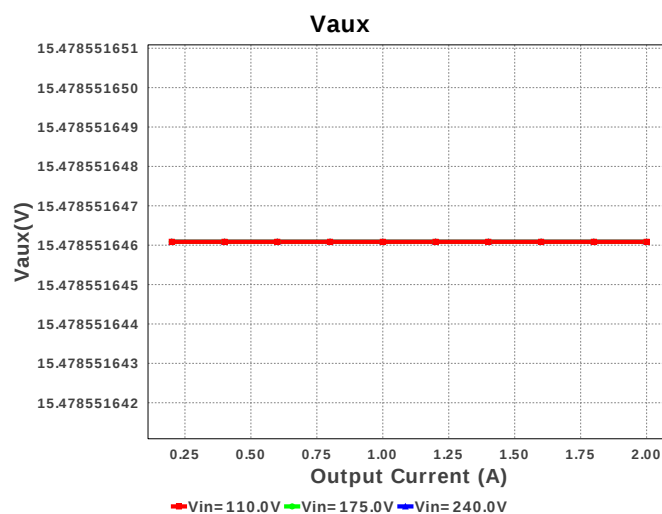
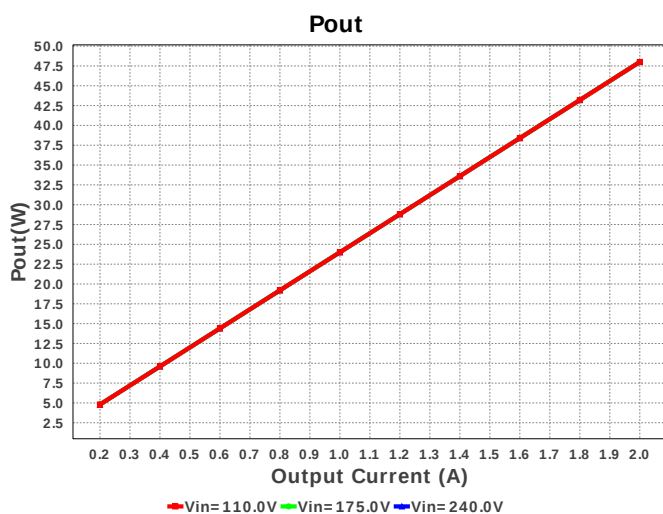
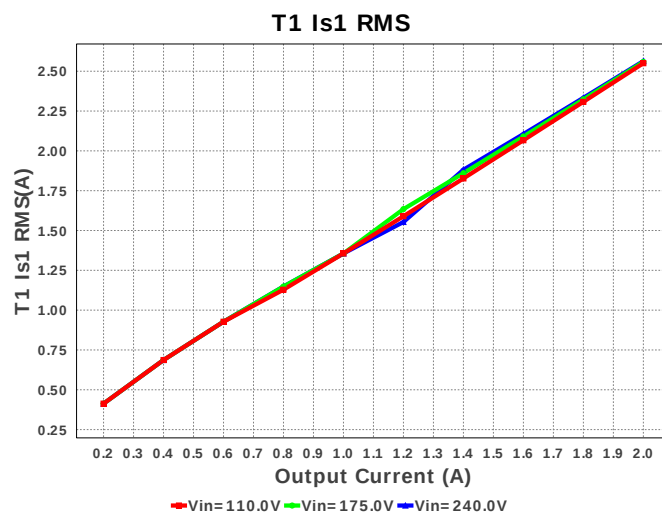
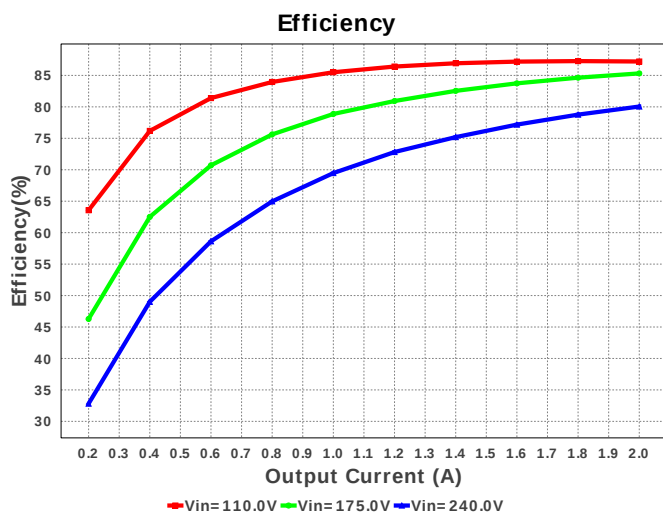


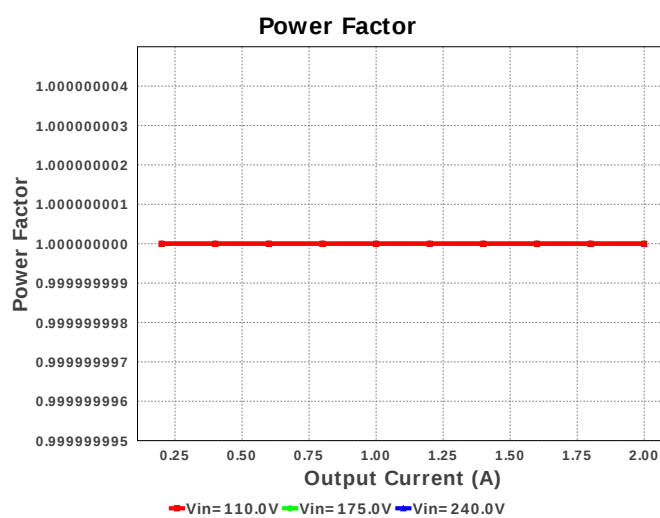
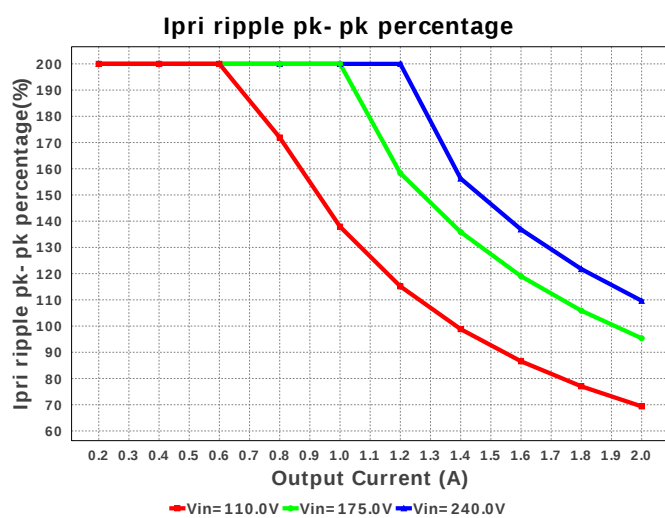
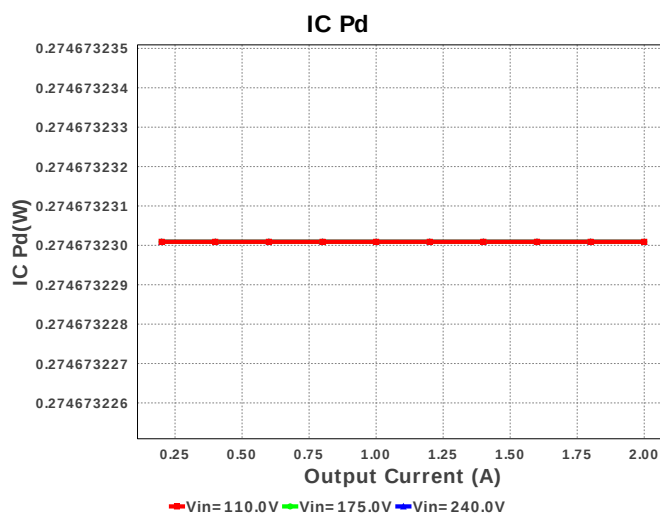
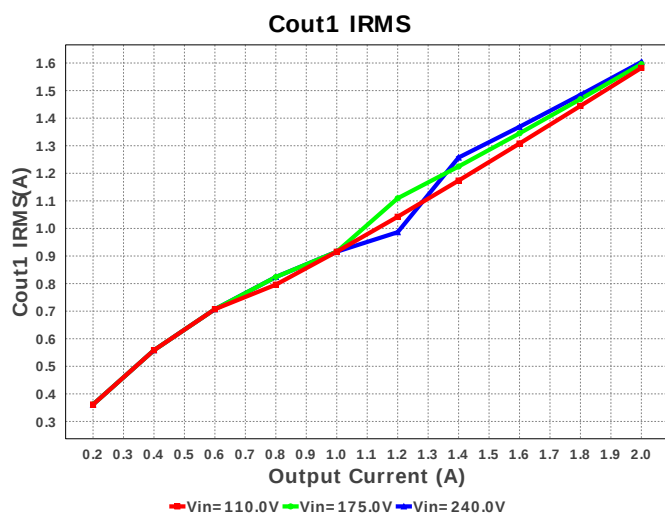
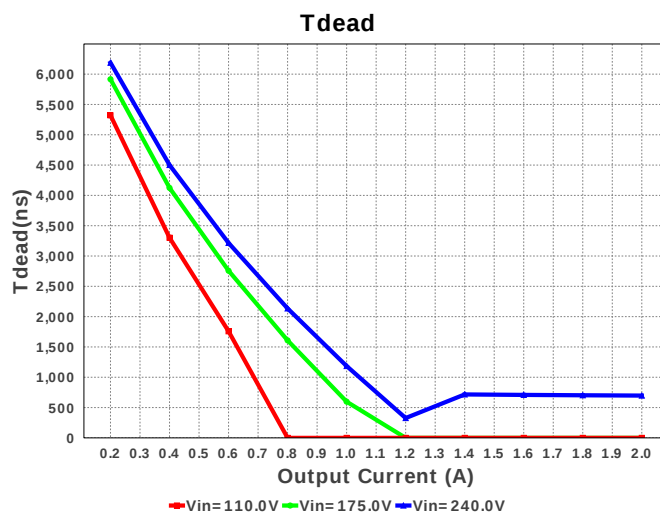
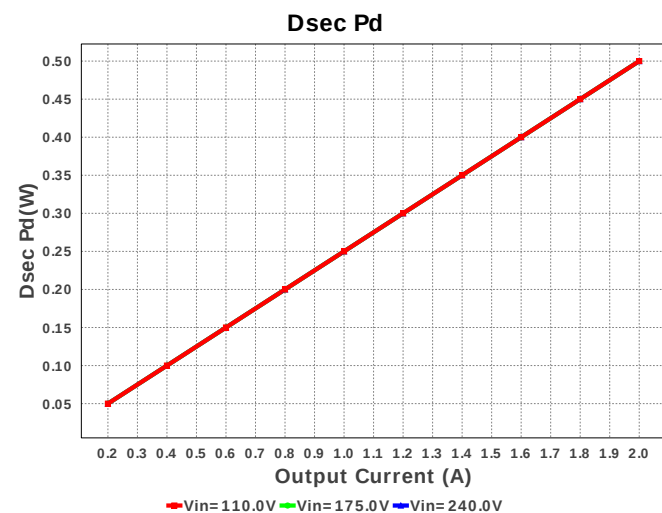


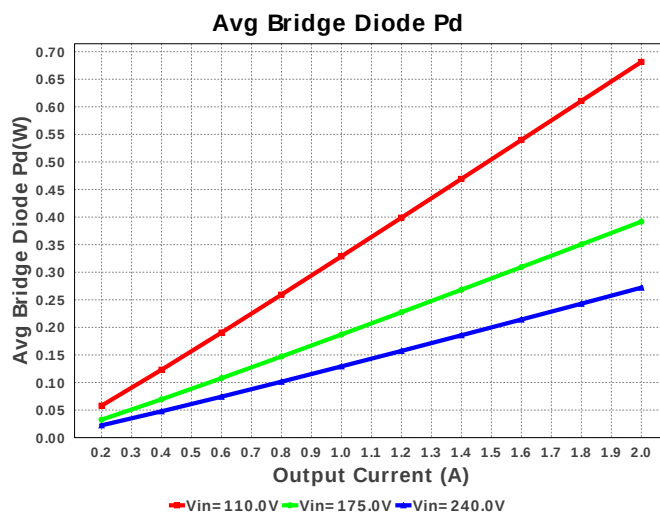
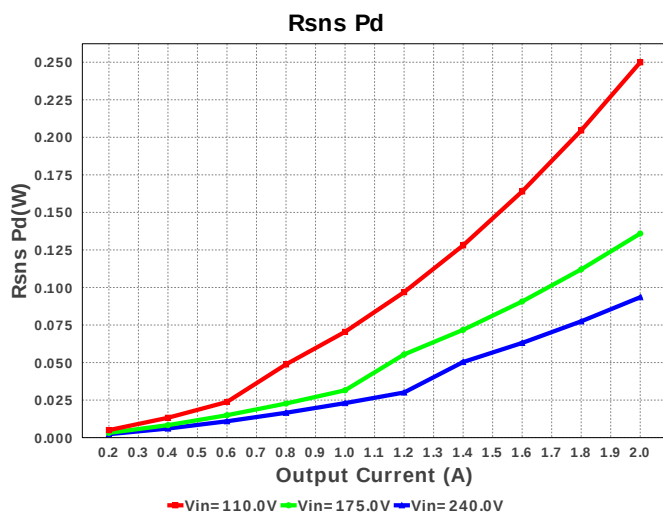
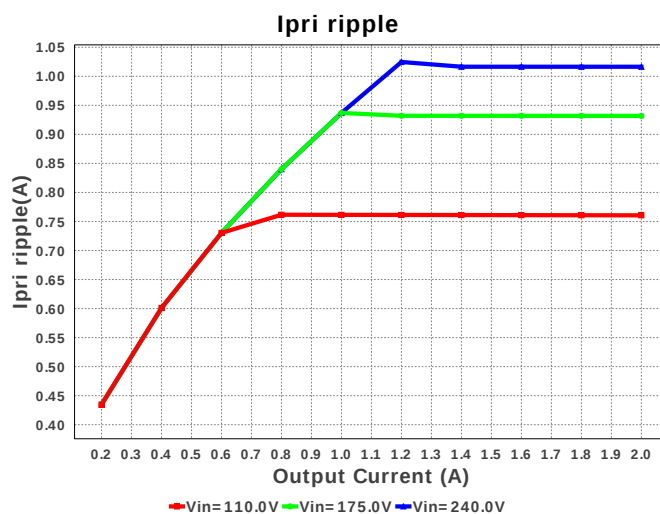
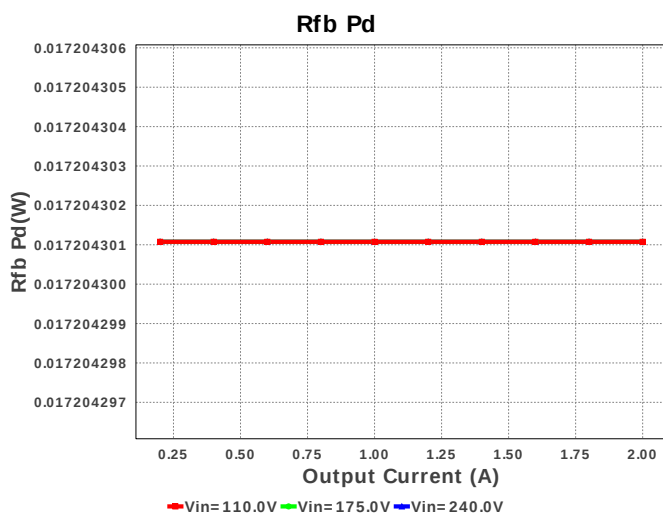
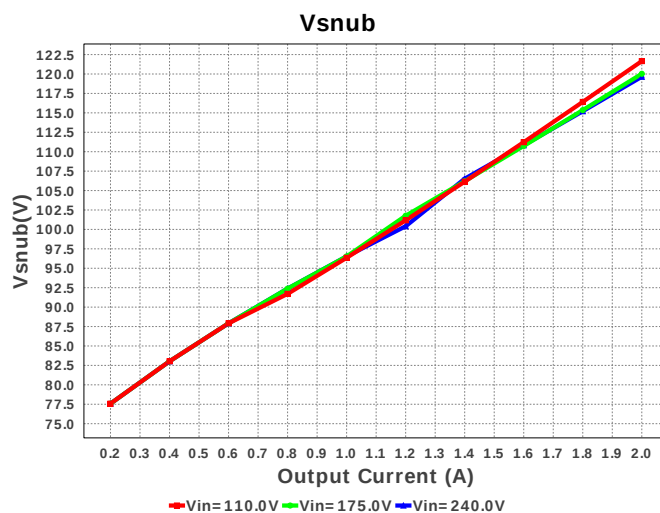
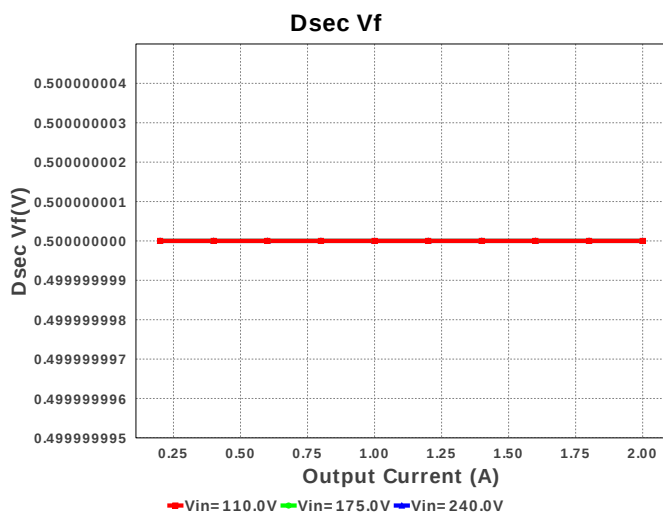


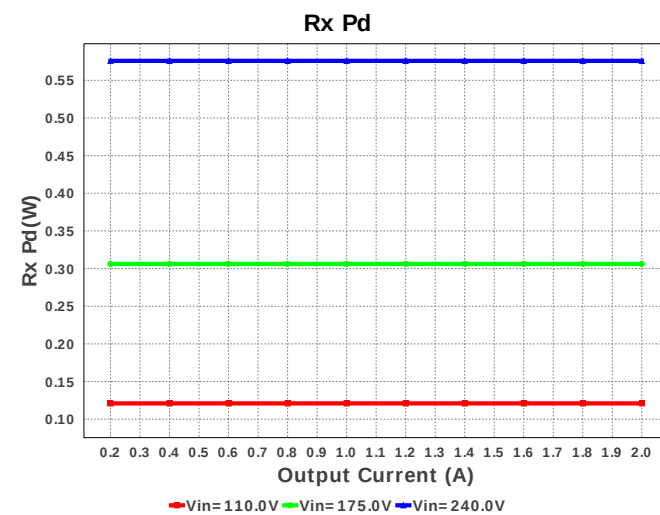
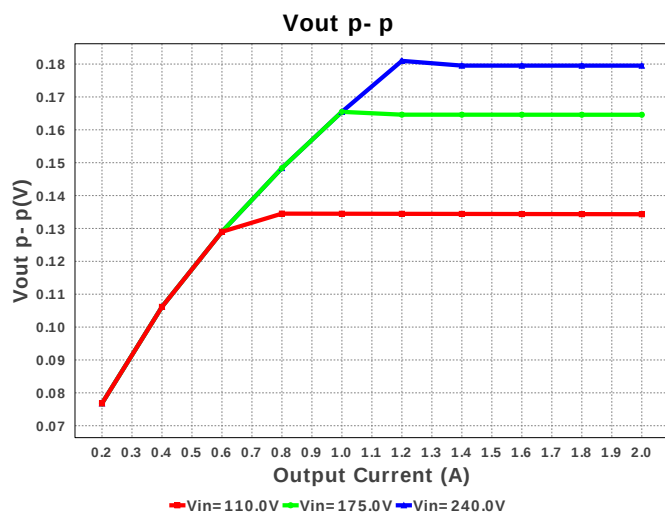
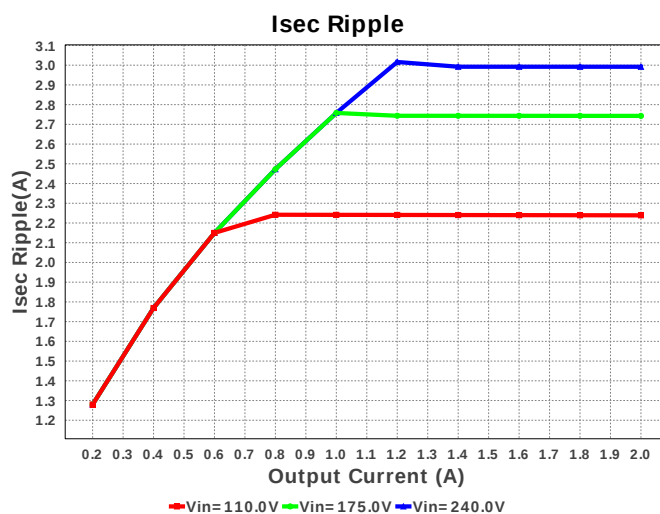
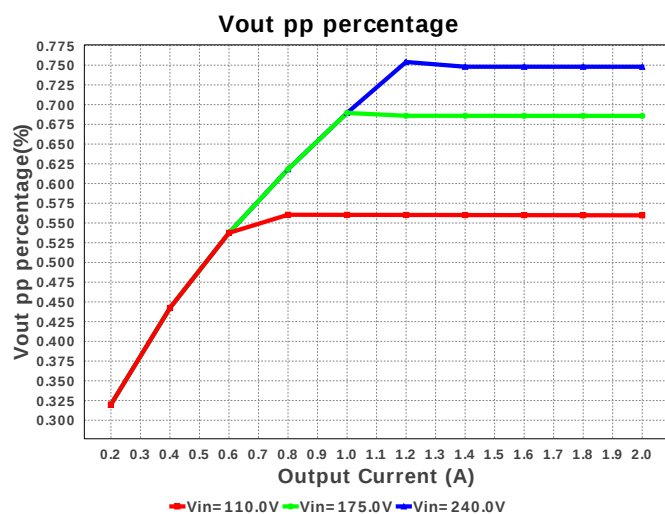
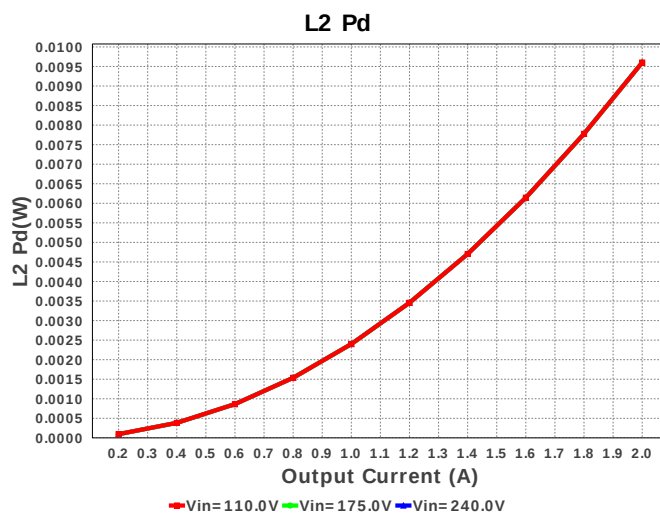
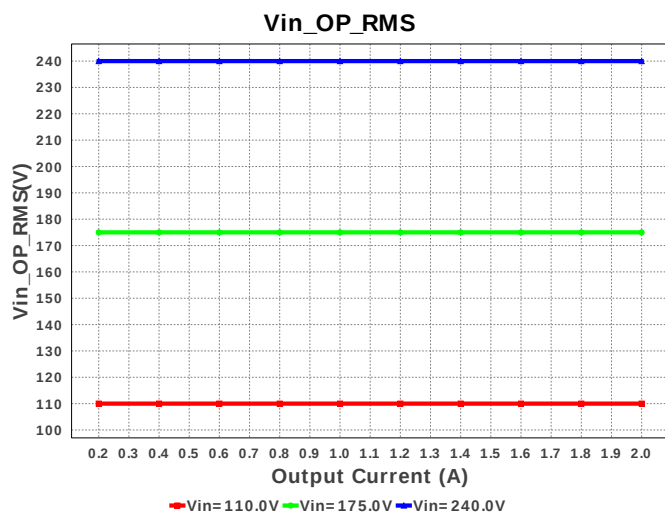


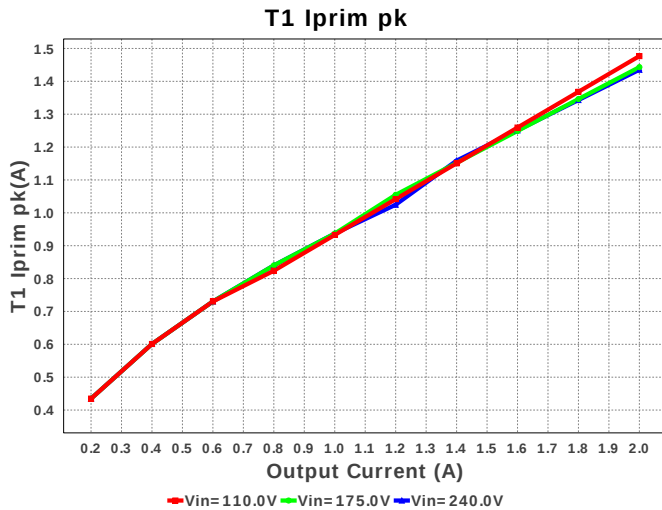












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	1.582 A	Current	Output capacitor1 RMS ripple current
2.	Iin rms	500.35 mA	Current	RMS Input Current
3.	Iout_DCM	693.553 mA	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	438.309 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	760.563 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	69.364 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	2.239 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	707.011 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	1.477 A	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	2.55 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	4.347 A	Current	Transformer Secondary1 Peak Current
12.	AC Frequency	50.0 Hz	General	Input AC frequency
13.	BOM Count	59	General	Total Design BOM count
14.	Daux trr	0.0 ns	General	Auxiliary Diode Reverse Recovery Time
15.	Dsec Vf	500.0 mV	General	Effective Forward Voltage Drop at the Operating Current
16.	Dsec trr	60.0 ns	General	Output Diode Reverse Recovery Time
17.	Dsec2 Vf	500.0 mV	General	Effective Forward Voltage Drop at the Operating Current
18.	Dsnub trr	30.0 ns	General	Snubber Diode Reverse Recovery Time
19.	FootPrint	4.904 k mm ²	General	Total Foot Print Area of BOM components
20.	Frequency	99.307 kHz	General	Switching frequency
21.	Pout	48.0 W	General	Total output power
22.	Power Factor	1.0	General	Assumed Power Factor for the Application
23.	Tdead	0.0 ns	General	Approximate Dead Time of the Regulator
24.	Toff	6.24 us	General	Approximate Converter Off Time
25.	Ton Act	4.025 us	General	Approximate Converter On Time
26.	Total BOM	\$0.0	General	Total BOM Cost
27.	Tsw	10.07 us	General	Switching Time Period
28.	Vaux	15.479 V	General	Auxiliary Voltage
29.	Vsnub	121.66 V	General	Voltage Across the Snubber
30.	Vout Actual	24.004 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
31.	Vout OP	24.0 V	Op_Point	Operational Output Voltage
32.	Duty Cycle	39.974 %	Op_point	Duty cycle
33.	Efficiency	87.212 %	Op_point	Steady state efficiency
34.	IC Tj	60.214 degC	Op_point	IC junction temperature
35.	ICThetaJA	110.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
36.	IOUT_OP	2.0 A	Op_point	Iout operating point
37.	M1 TJOP	84.369 degC	Op_point	M1 MOSFET junction temperature
38.	Peak Rectified Vin	155.562 V	Op_point	Peak voltage seen at rectified input
39.	Vin_OP_RMS	110.0 V	Op_point	AC Input RMS Voltage
40.	Vout p-p	134.328 mV	Op_point	Peak-to-peak output ripple voltage
41.	Avg Bridge Diode Pd	681.457 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
42.	Cbulk Pd	1.246 W	Power	Bulk capacitor power dissipation
43.	Cout1 Pd	150.227 mW	Power	Output capacitor1 power dissipation
44.	Cx Pd	0.0 W	Power	X-cap Power Dissipation
45.	Cy Pd	0.0 W	Power	Y-caps Power Dissipation
46.	Dsec Pd	500.0 mW	Power	Secondary Diode Power Dissipation
47.	Dsec2 Pd	500.0 mW	Power	Secondary Diode Power Dissipation
48.	IC Pd	274.673 mW	Power	IC power dissipation
49.	L1 Pd	15.376 mW	Power	Power Dissipation in the Inductor
50.	L2 Pd	9.6 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period

#	Name	Value	Category	Description
51.	M1 Pd	655.052 mW	Power	M1 MOSFET total power dissipation
52.	Paux	14.825 mW	Power	Power Dissipation in Raux and Daux
53.	Pd Rstartup	1.529 W	Power	Power Dissipation in Rstartup1 and Rstartup2
54.	Rdrv Pd	13.993 μ W	Power	Power Dissipation in Gate Drive Resistor
55.	Rfb Pd	17.204 mW	Power	Rfb Power Dissipation
56.	Rsns Pd	249.932 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	743.891 mW	Power	Snubber Power Dissipation
59.	T1 Pd	981.63 mW	Power	Estimated Losses in Transformer
60.	Total Pd	7.038 W	Power	Total Power Dissipation
61.	Vout Tolerance	2.137 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
62.	Vout pp percentage	559.7 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	240.0	Maximum input voltage
3.	VinMin	110.0	Minimum input voltage
4.	Vout	24.0	Output Voltage
5.	line_fsw	50.0	Light Output in Lumen
6.	base_pn	UC2844	Base Product Number
7.	source	AC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

1. **UC2844** Product Folder : <http://www.ti.com/product/UC2844> : contains the data sheet and other resources.

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