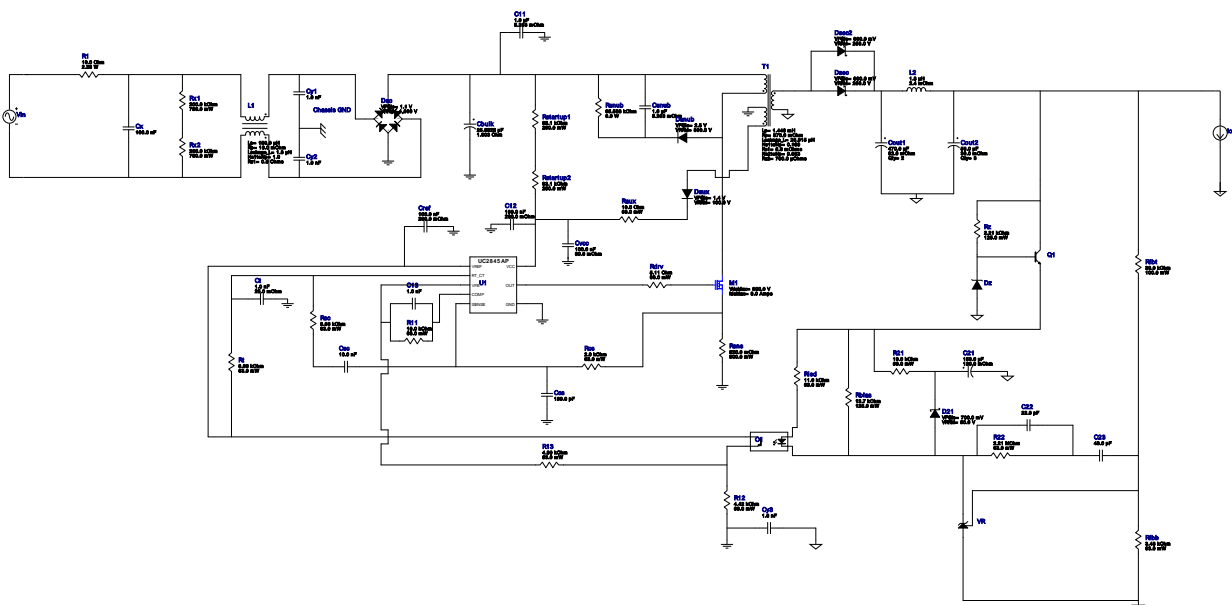




WEBENCH® Design Report

Design : 4466246/65 UC2845AN
UC2845AN 220.0V-220.0V to 24.00V @ 2.0A



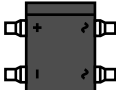

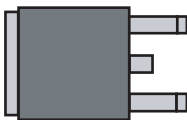
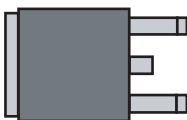


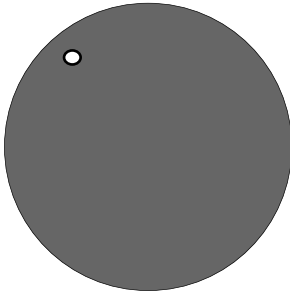

























1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.



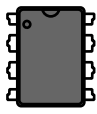

Electrical BOM

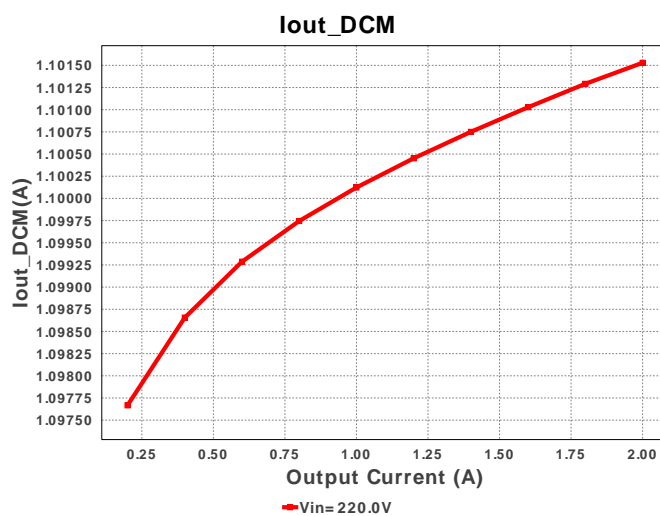
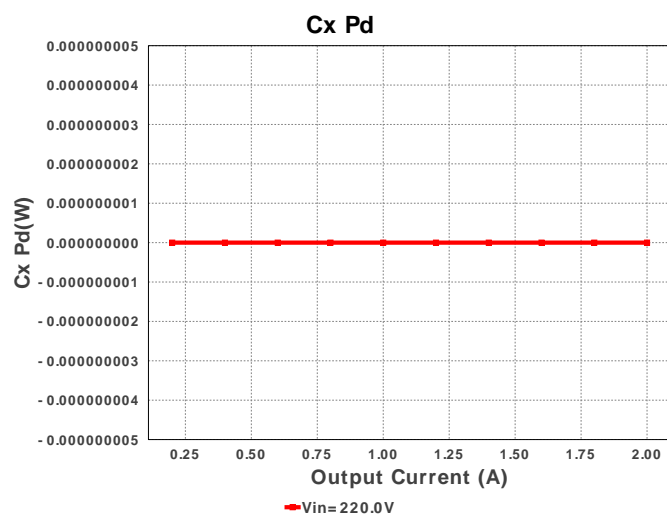
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C11	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	\$1.19	 2220 54 mm ²
2.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
3.	C13	Samsung 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	Nichicon	UUD1H151MNL1GS Series= uD	Cap= 150.0 uF ESR= 180.0 mOhm VDC= 50.0 V IRMS= 670.0 mA	1	\$0.26	 SM_RADIAL_10BMM 160 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	CL21C430JBANNNC Series= C0G/NP0	Cap= 43.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
7.	Cbulk	CUSTOM	CUSTOM Series= ?	Cap= 25.6326 uF ESR= 1.60338 Ohm VDC= 373.349 V IRMS= 529.43 mA	1	NA	CUSTOM 0 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

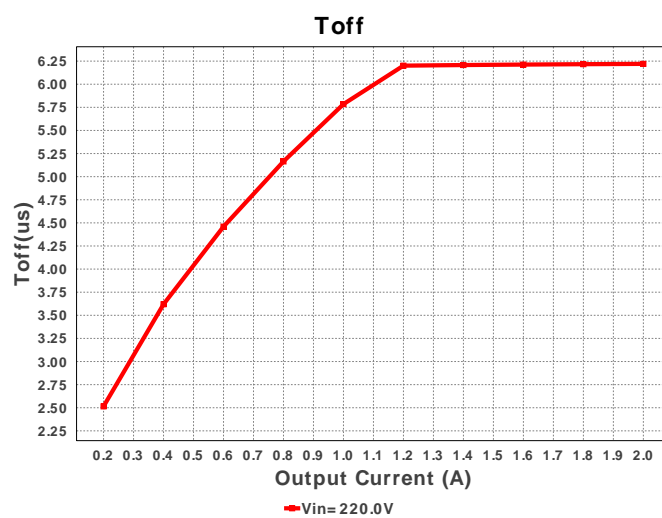
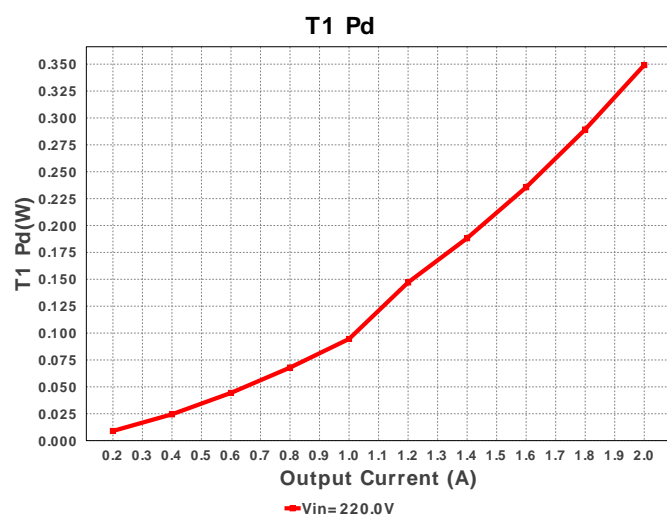
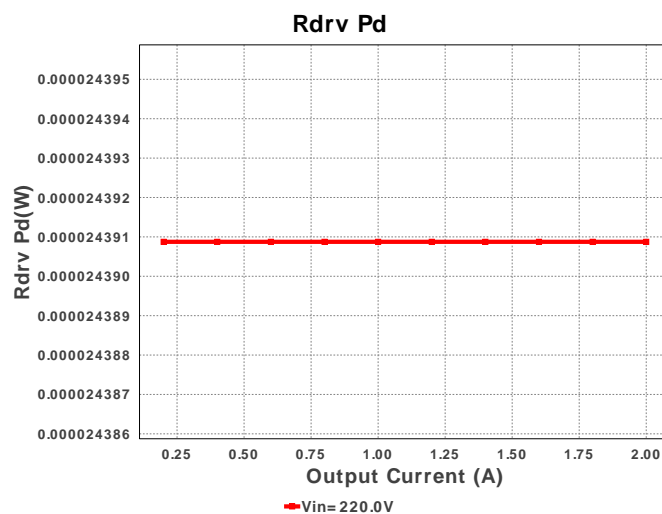
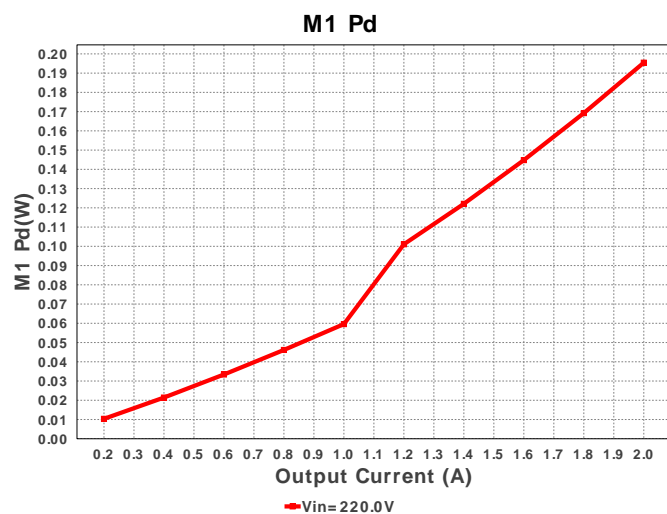
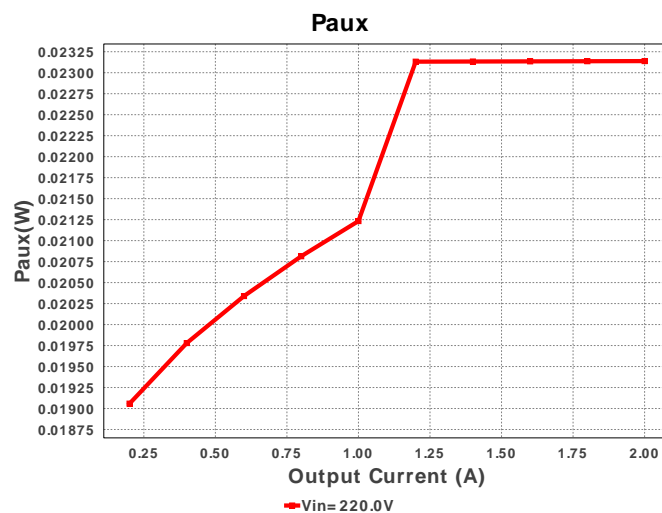
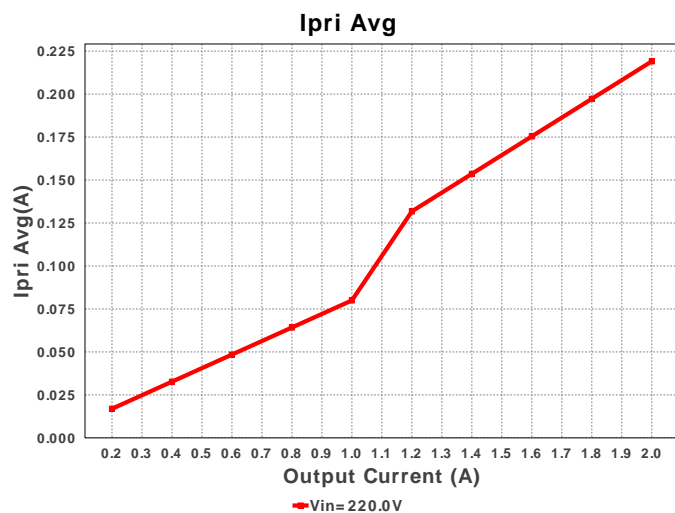
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9.	Cout1	Panasonic	EEV-FK1J471M Series= FK	Cap= 470.0 uF ESR= 82.0 mOhm VDC= 63.0 V IRMS= 1.41 A	2	\$0.78	 SM_RADIAL_J16 399 mm ²
10.	Cout2	Panasonic	EEHZA1J560P Series= ?	Cap= 56.0 uF ESR= 30.0 mOhm VDC= 63.0 V IRMS= 1.8 A	3	\$1.05	 SM_RADIAL_10BMM 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
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

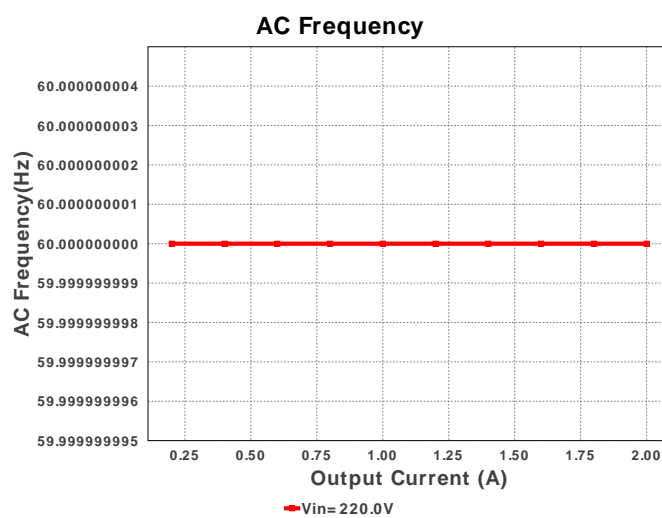
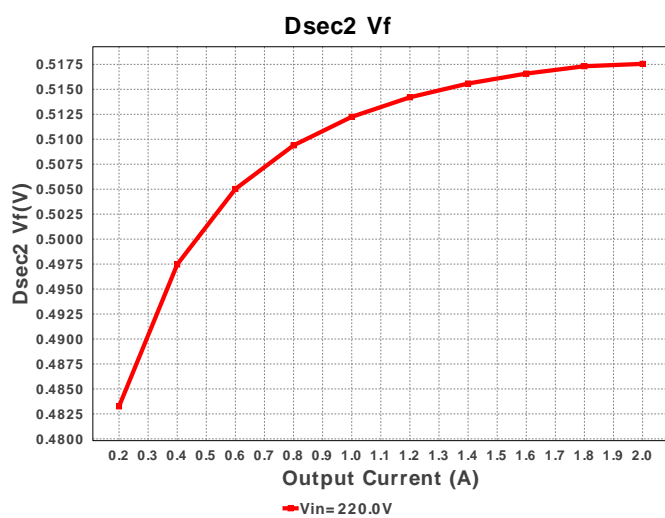
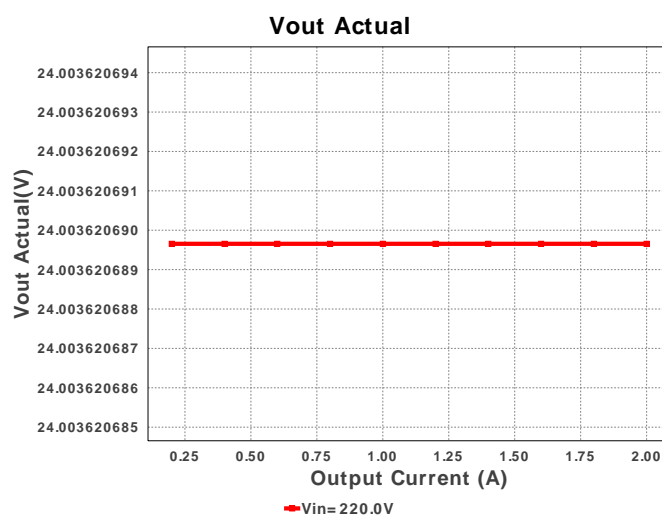
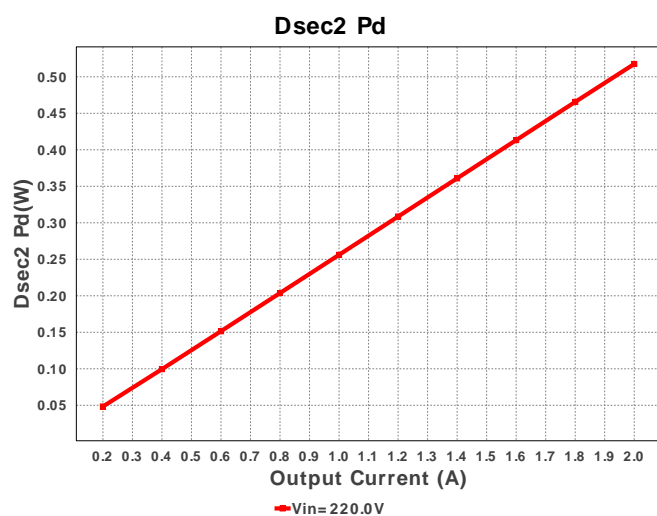
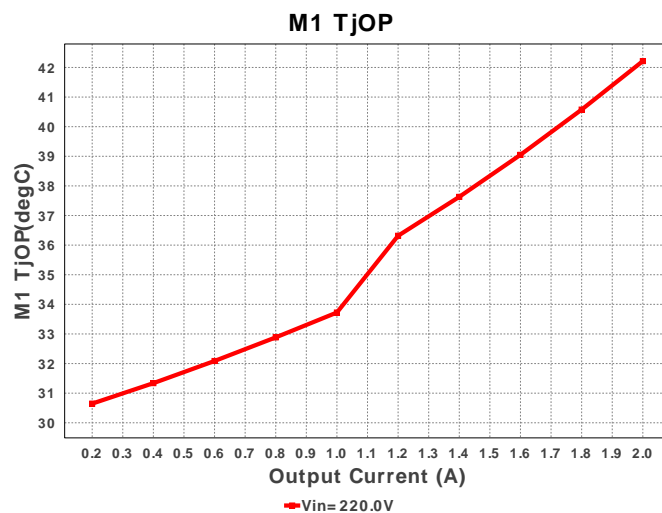
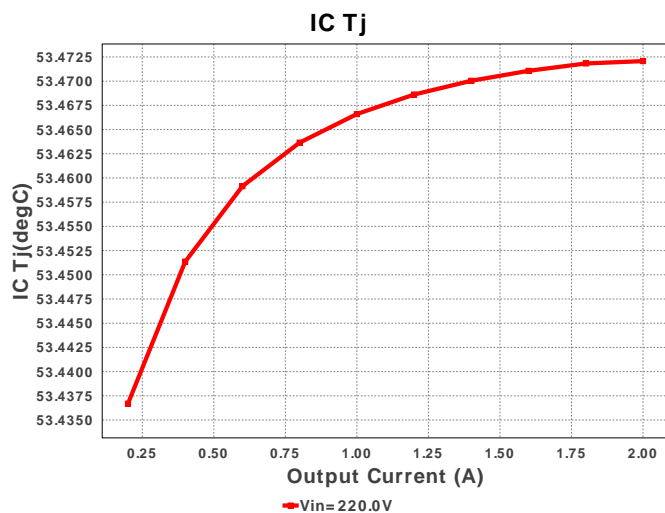
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
19.	Cy3	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm ²
20.	D21	Diodes Inc.	B260A-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.09	 SMA 37 mm ²
21.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	\$0.24	 DF-S 99 mm ²
22.	Daux	NXP Semiconductor	BAS316,115	VF@Io= 1.4 V VRRM= 100.0 V	1	\$0.02	 SOD-323 9 mm ²
23.	Dsec	ON Semiconductor	MBRB40250TG	VF@Io= 860.0 mV VRRM= 250.0 V	1	\$0.94	 DDPAK 210 mm ²
24.	Dsec2	ON Semiconductor	MBRB40250TG	VF@Io= 860.0 mV VRRM= 250.0 V	1	\$0.94	 DDPAK 210 mm ²
25.	Dsnub	Bourns	CD1408-FU1800	VF@Io= 2.5 V VRRM= 800.0 V	1	\$0.13	 Diode_1408 13 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
28.	L2	Coilcraft	SER1360-182KLB	L= 1.8 µH DCR= 2.4 mOhm	1	\$0.72	 SER1360 225 mm ²
29.	M1	STMicroelectronics	STF10N80K5	VdsMax= 800.0 V IdsMax= 9.0 Amps	1	\$2.52	 TO-220FP 79 mm ²
30.	O1	Vishay-Semiconductor	TCMT1107	Optocoupler	1	\$0.21	 SOP-4 44 mm ²

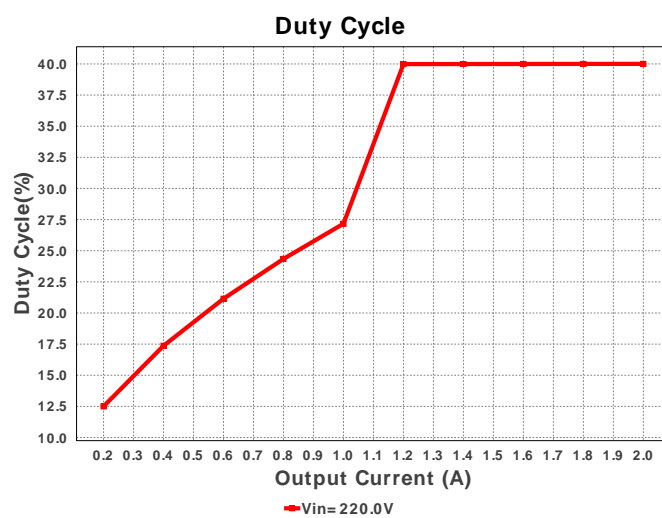
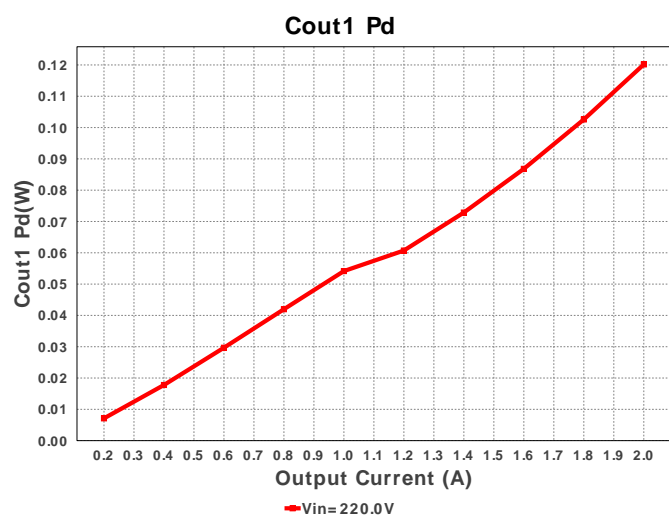
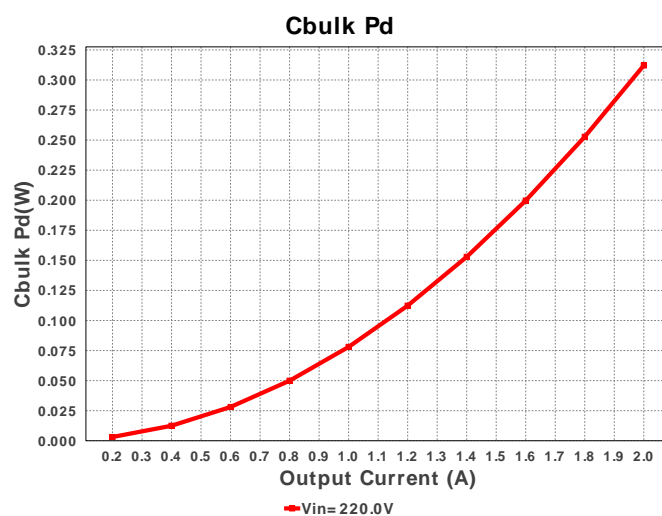
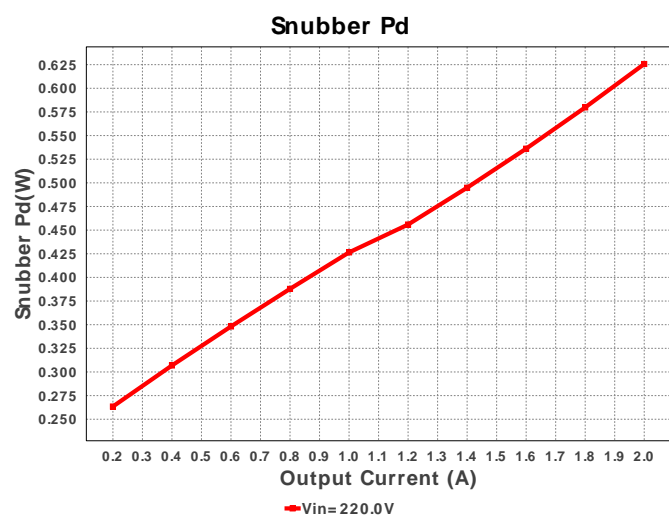
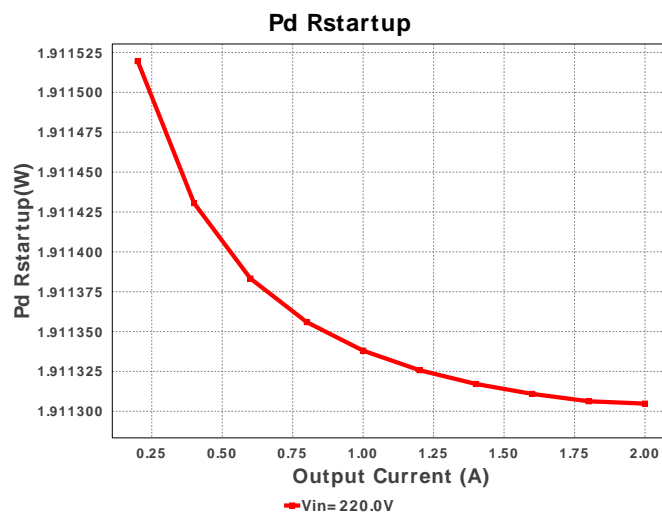
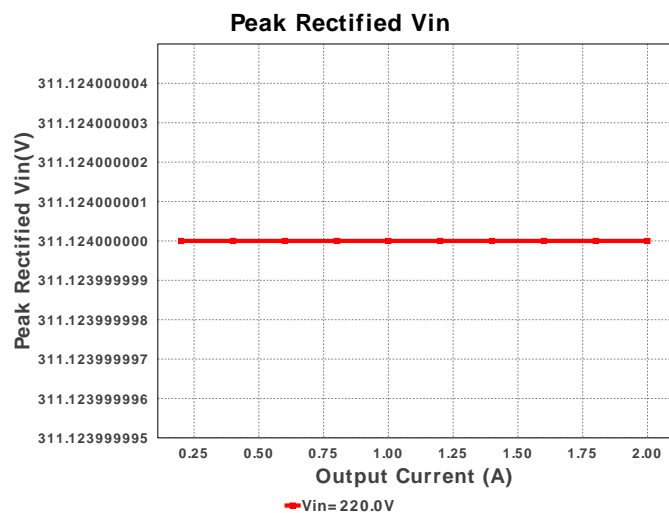
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
31.	Q1	ON Semiconductor	BC846BLT1G	Bipolar Transistor	1	\$0.02	 SOT-23 14 mm ²
32.	R1	Vishay-Dale	AC03000001009JACCS Series= F_RES	Res= 10.0 Ohm Power= 2.25 W Tolerance= 5.0%	1	\$0.30	 AC03 158 mm ²
33.	R11	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
34.	R12	Vishay-Dale	CRCW04024K42FKED Series= CRCW..e3	Res= 4.42 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	CRCW04022M21FKED Series= CRCW..e3	Res= 2.21 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	CRCW04025R11FKED Series= CRCW..e3	Res= 5.11 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	CRCW040211K0FKED Series= CRCW..e3	Res= 11.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
45.	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
46.	Rsns	Rohm	MCR25JZHFLR820 Series= MCR25	Res= 820.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.03	 1210 15 mm ²
47.	Rsnub	CUSTOM	CUSTOM Series= ?	Res= 95.568 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm ²
48.	Rstartup1	Panasonic	ERJ-8ENF9312V Series= ERJ-8E	Res= 93.1 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
49.	Rstartup2	Panasonic	ERJ-8ENF9312V Series= ERJ-8E	Res= 93.1 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

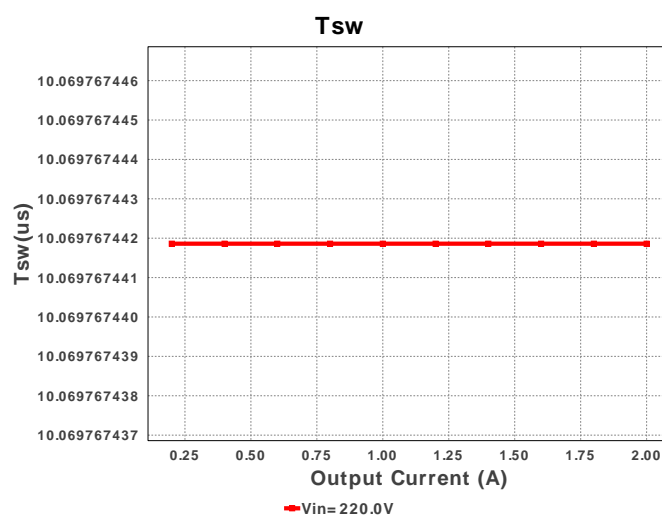
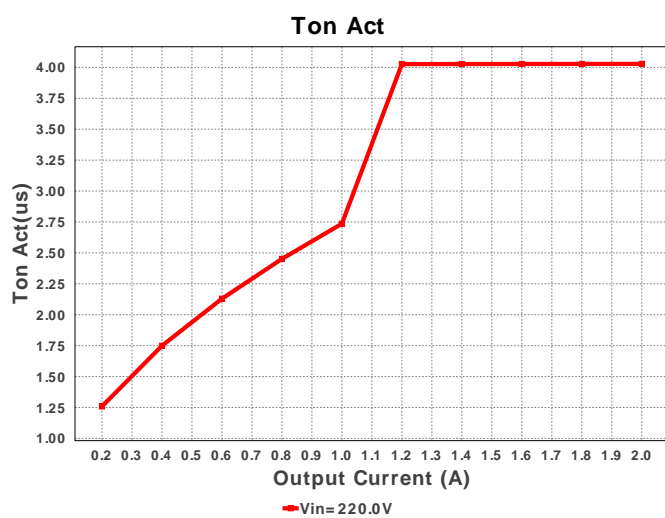
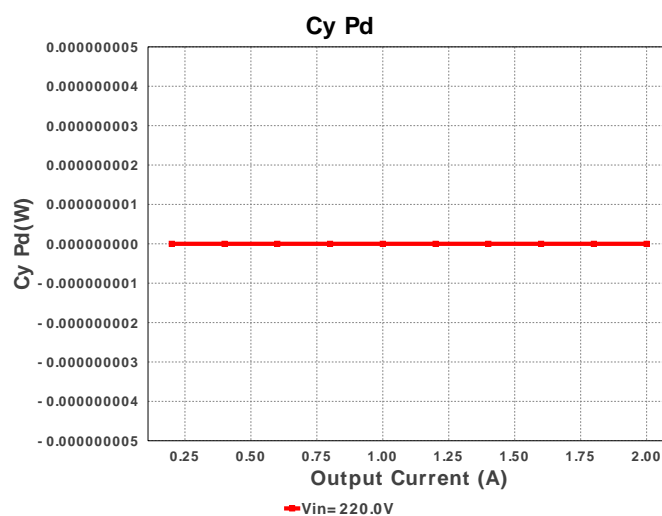
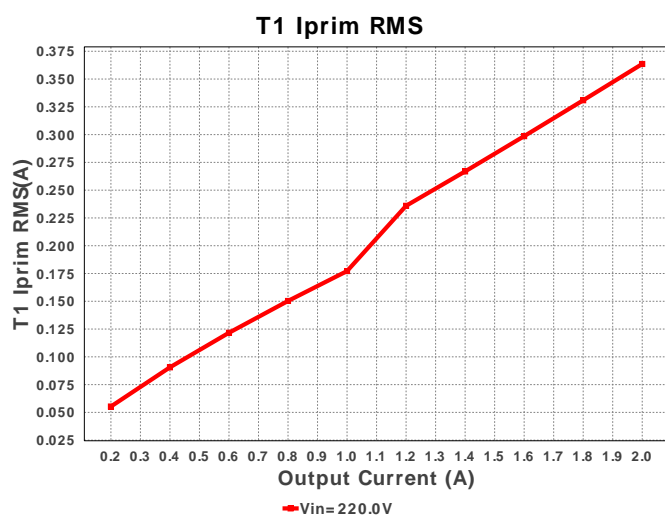
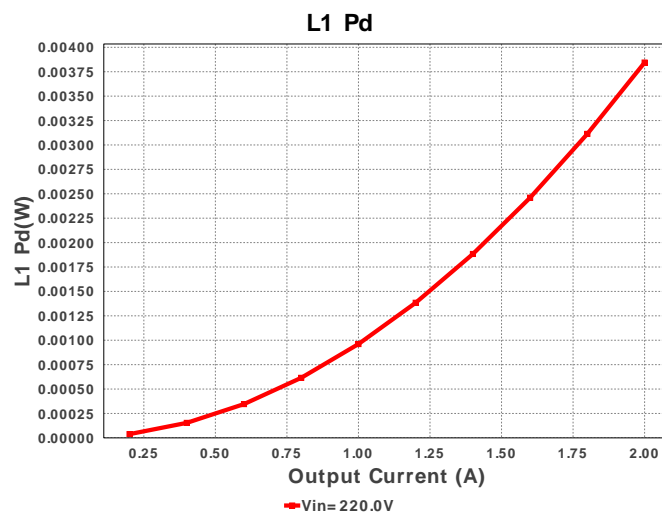
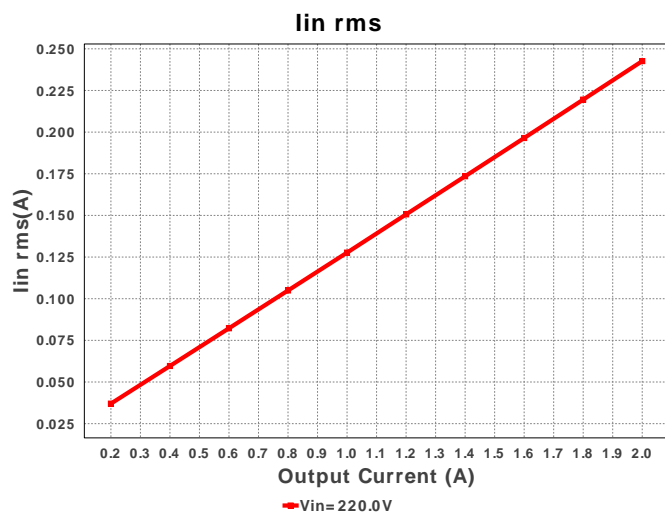
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
52.	Rx2	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm ²
53.	Rz	Panasonic	ERJ-6ENF2211V Series= ERJ-6E	Res= 2.21 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
54.	T1	CUSTOM	CUSTOM	Lp= 1.446 mH Rp= 870.0 mOhm Leakage_L= 28.915 μH Ns1toNp= 0.169 Rs1= 8.6 mOhms Ns2toNp= 0.083 Rs2= 700.0 μOhms	1	NA	CUSTOM 0 mm ²
55.	U1	Texas Instruments	UC2845AN	Switcher	1	\$0.64	 P0008A 116 mm ²
56.	VR	Texas Instruments	TL431AIDBVR	Voltage References	1	\$0.07	 R-PDSO-G3 16 mm ²



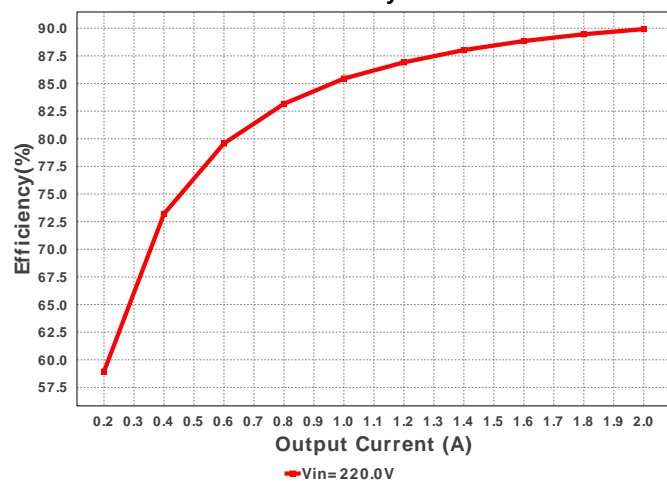




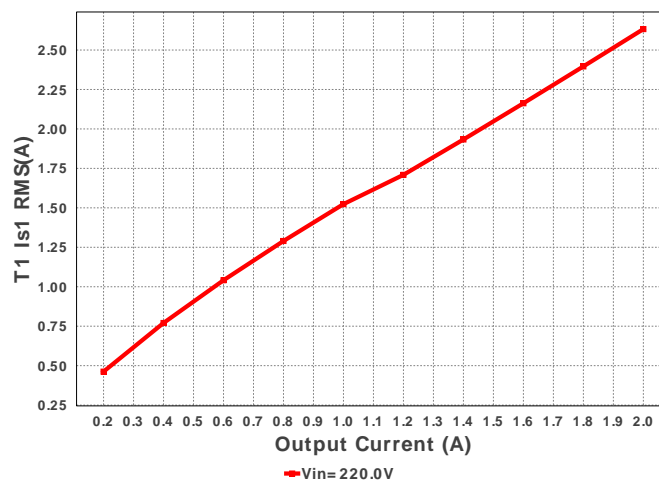




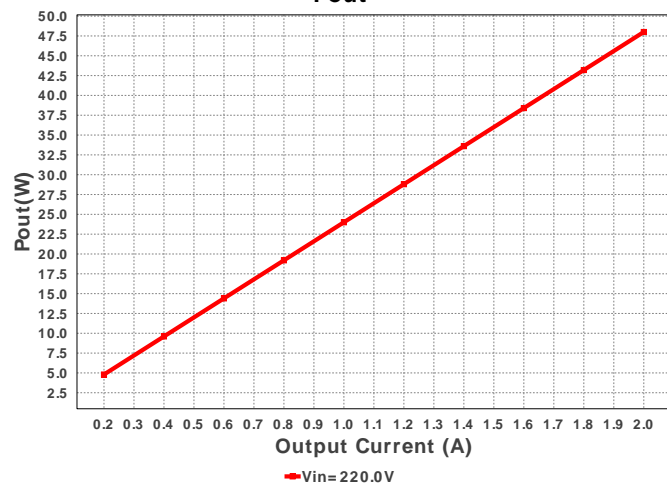
Efficiency



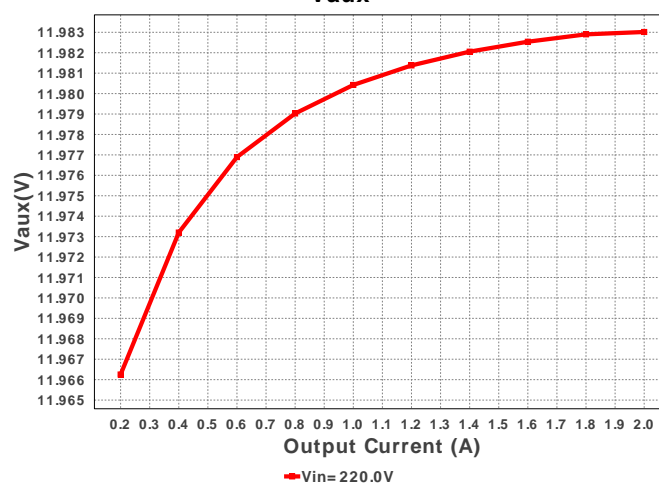
T1 Is1 RMS



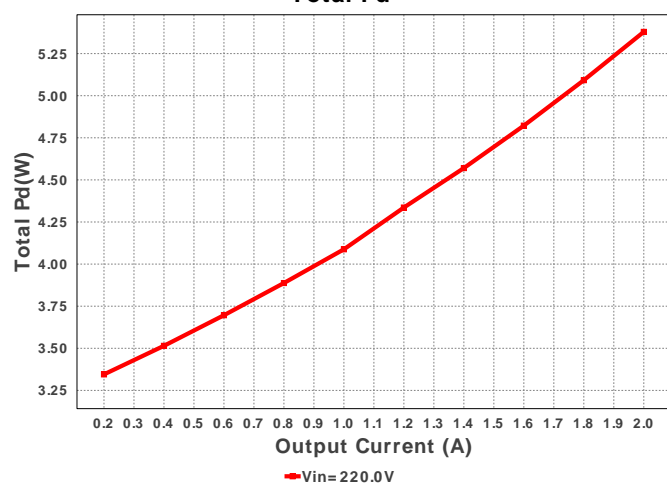
Pout



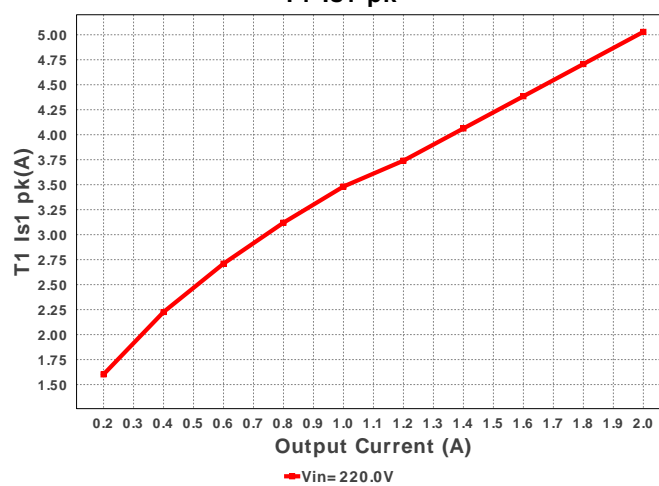
Vaux

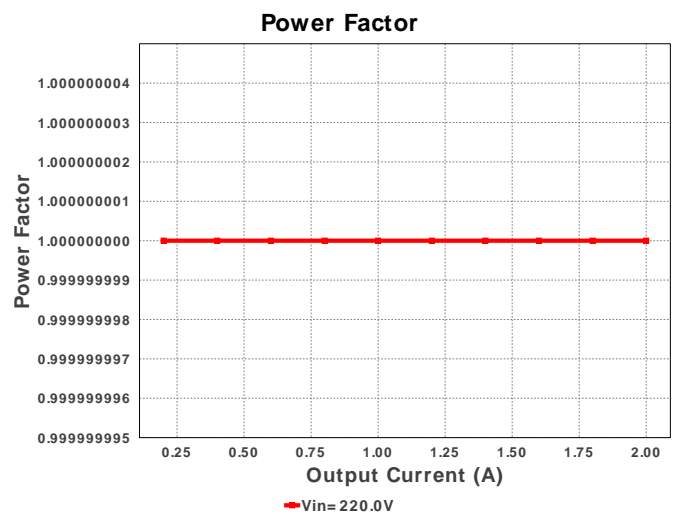
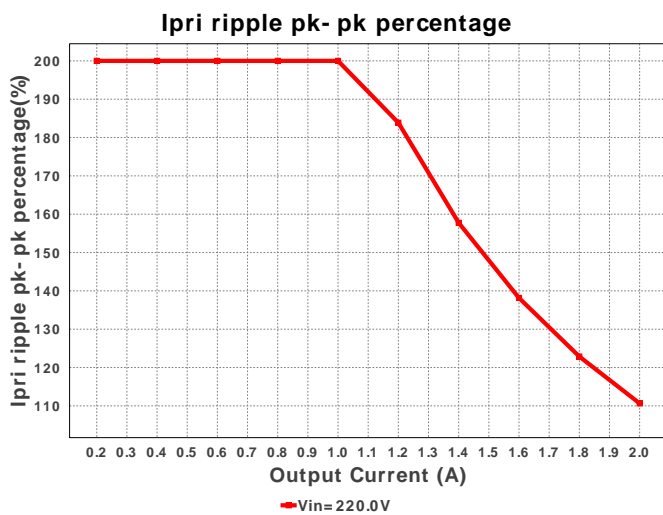
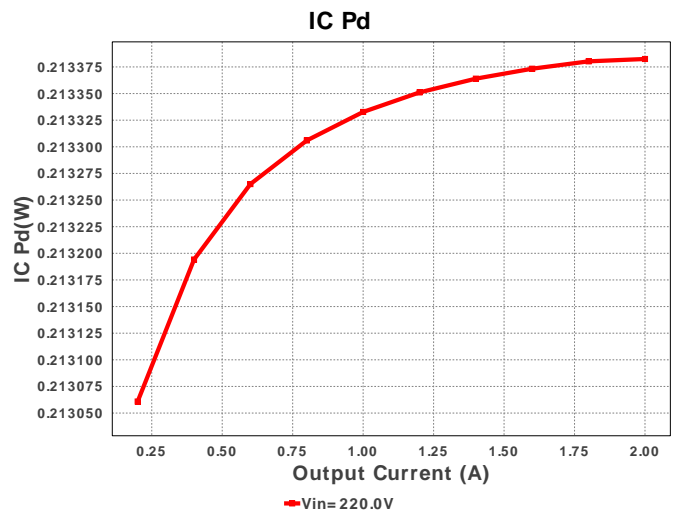
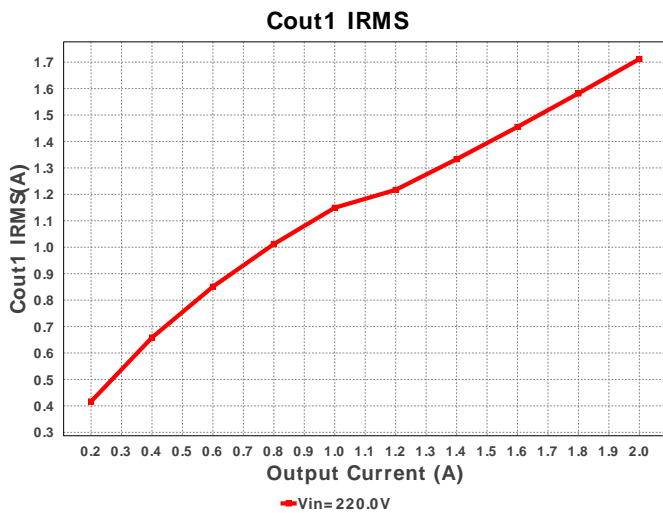
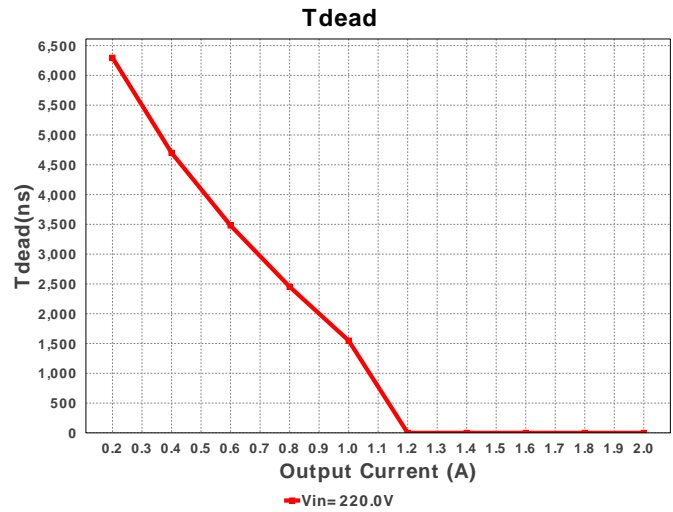
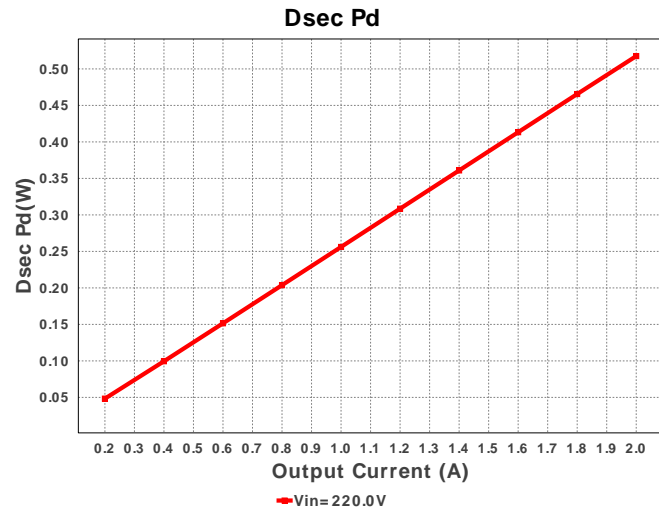


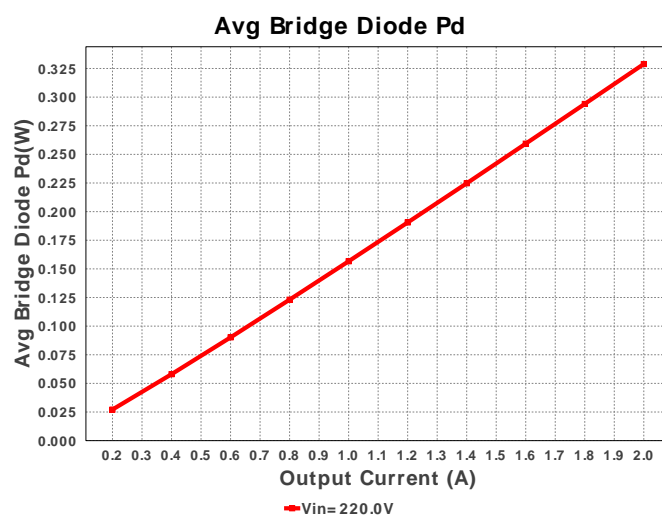
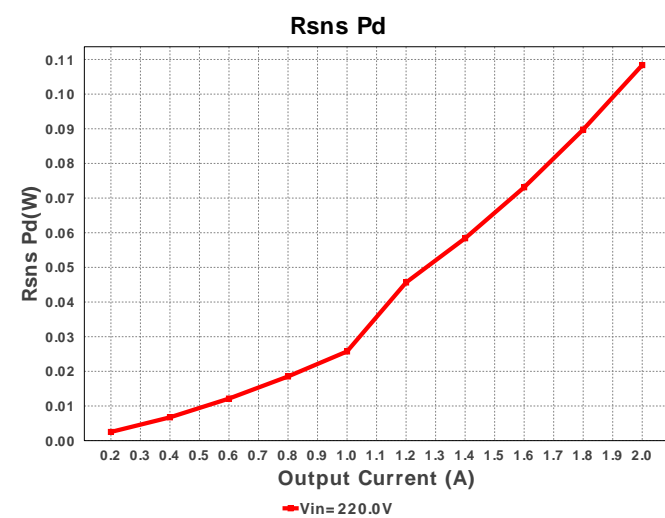
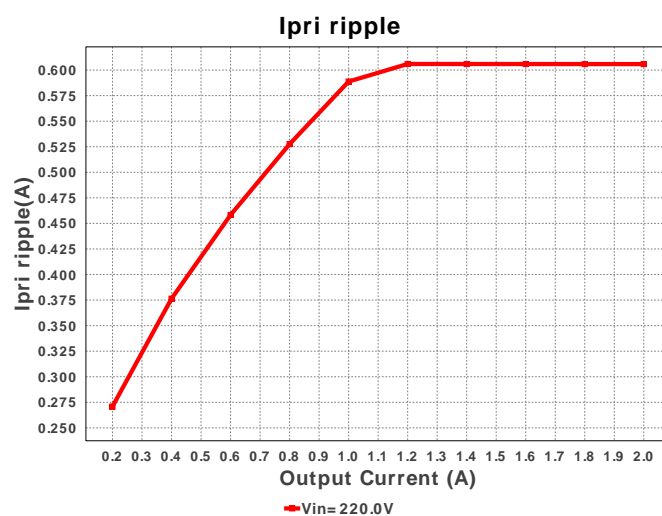
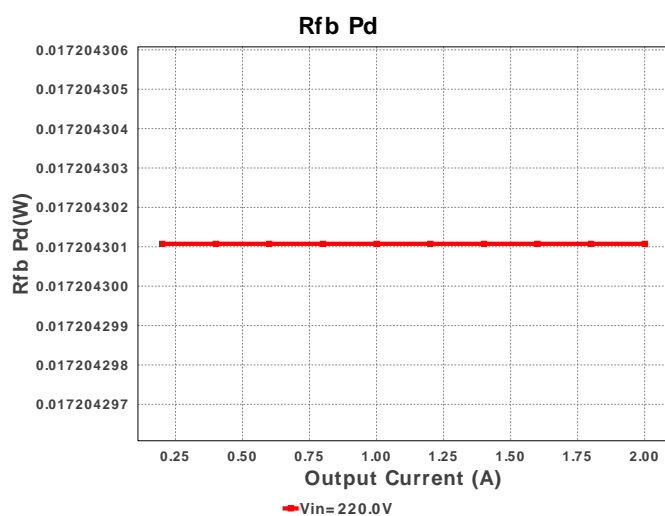
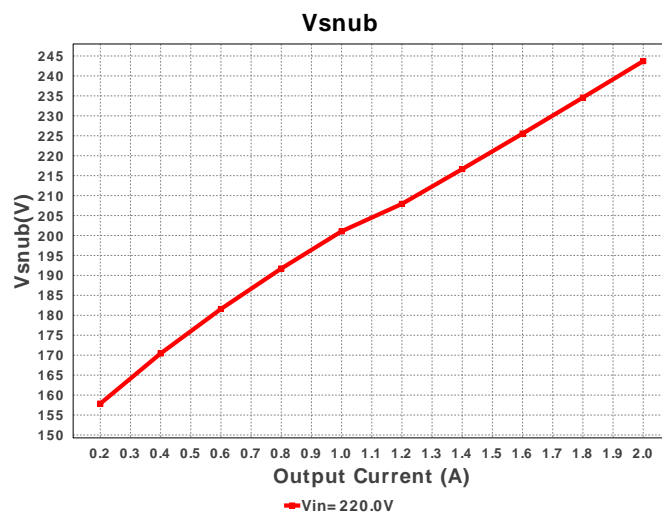
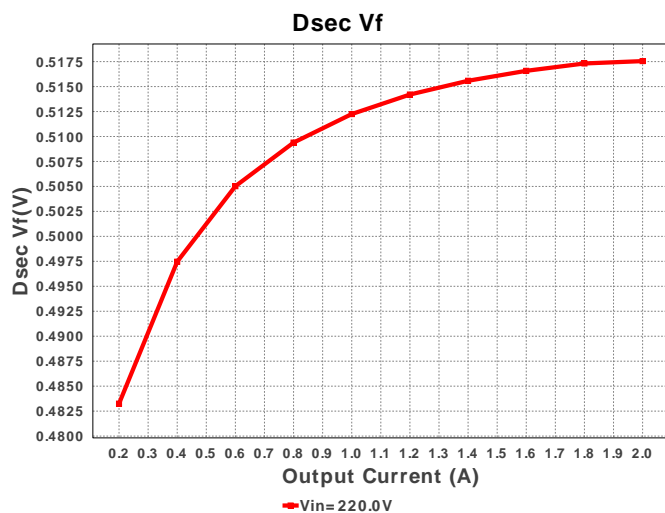
Total Pd

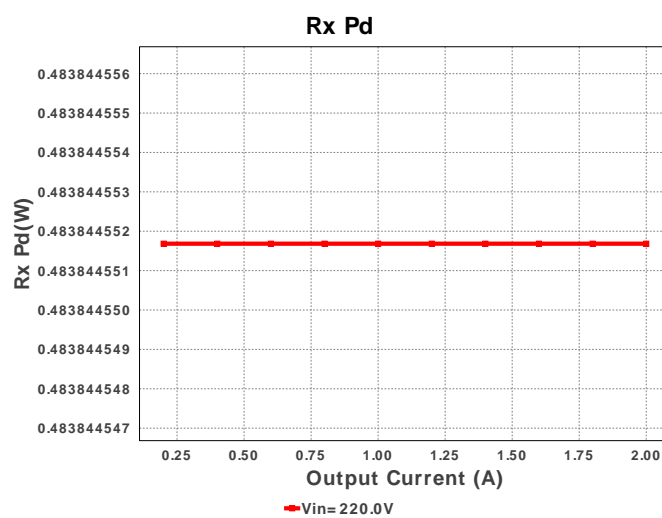
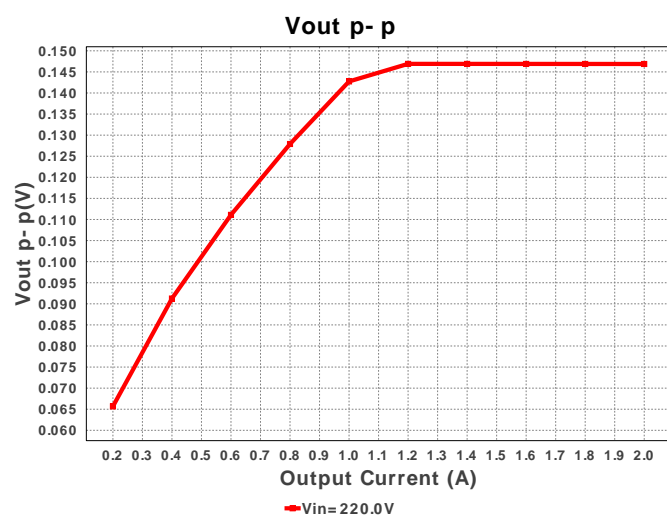
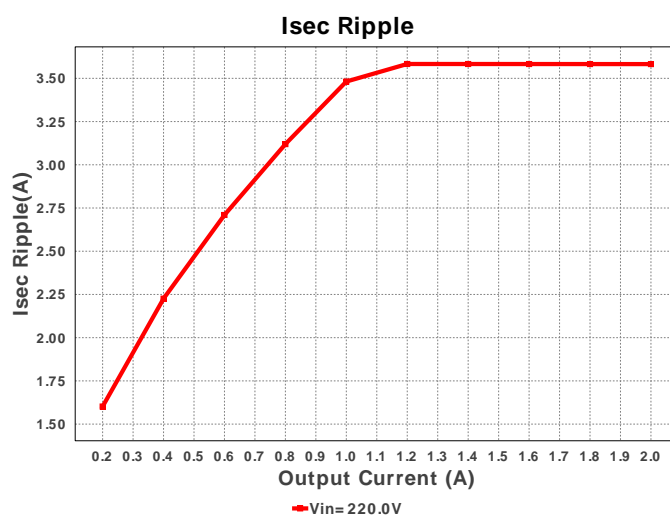
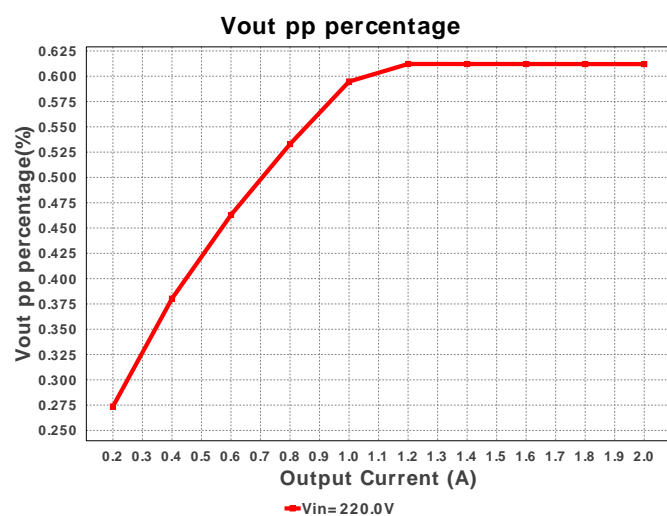
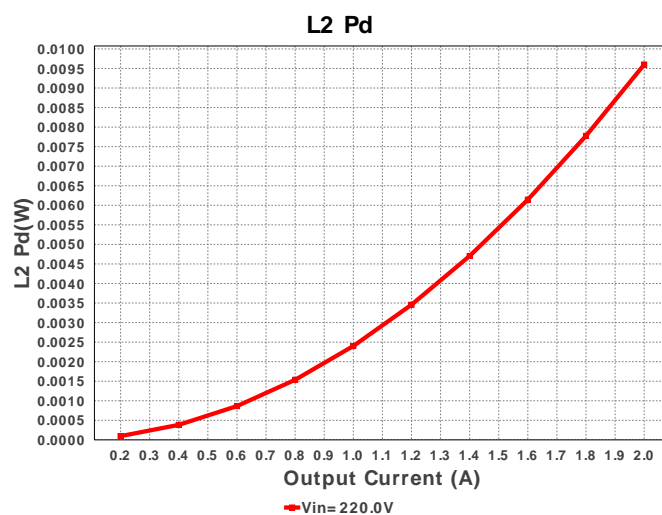
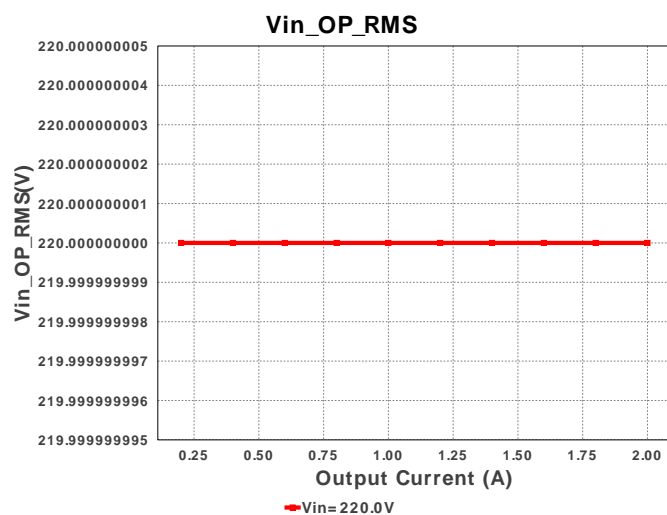


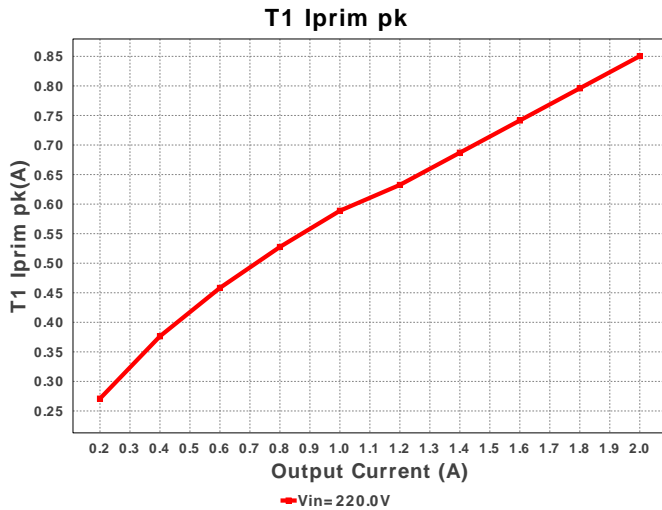
T1 Is1 pk











Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	1.712 A	Current	Output capacitor1 RMS ripple current
2.	Iin rms	242.63 mA	Current	RMS Input Current
3.	Iout_DCM	1.102 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	219.046 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	605.823 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	110.645 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	3.582 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	363.555 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	850.45 mA	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	2.633 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	5.029 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	4.0 ns	General	Auxiliary Diode Reverse Recovery Time
15.	Dsec Vf	517.55 mV	General	Effective Forward Voltage Drop at the Operating Current
16.	Dsec trr	0.0 ns	General	Output Diode Reverse Recovery Time
17.	Dsec2 Vf	517.55 mV	General	Effective Forward Voltage Drop at the Operating Current
18.	Dsnub trr	35.0 ns	General	Snubber Diode Reverse Recovery Time
19.	FootPrint	4.496 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	6.22 us	General	Approximate Converter Off Time
25.	Ton Act	4.028 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	11.983 V	General	Auxiliary Voltage
29.	Vsnub	243.715 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	40.006 %	Op_point	Duty cycle
33.	Efficiency	89.923 %	Op_point	Steady state efficiency
34.	IC Tj	53.472 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	42.215 degC	Op_point	M1 MOSFET junction temperature
38.	Peak Rectified Vin	311.124 V	Op_point	Peak voltage seen at rectified input
39.	Vin_OP_RMS	220.0 V	Op_point	AC Input RMS Voltage
40.	Vout p-p	146.878 mV	Op_point	Peak-to-peak output ripple voltage
41.	Avg Bridge Diode Pd	328.905 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
42.	Cbulk Pd	312.097 mW	Power	Bulk capacitor power dissipation
43.	Cout1 Pd	120.162 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	517.55 mW	Power	Secondary Diode Power Dissipation
47.	Dsec2 Pd	517.55 mW	Power	Secondary Diode Power Dissipation
48.	IC Pd	213.382 mW	Power	IC power dissipation
49.	L1 Pd	3.844 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	195.436 mW	Power	M1 MOSFET total power dissipation
52.	Paux	23.138 mW	Power	Power Dissipation in Raux and Daux
53.	Pd Rstartup	1.911 W	Power	Power Dissipation in Rstartup1 and Rstartup2
54.	Rdrv Pd	24.391 μ W	Power	Power Dissipation in Gate Drive Resistor
55.	Rfb Pd	17.204 mW	Power	Rfb Power Dissipation
56.	Rsns Pd	108.381 mW	Power	Current Limit Sense Resistor Power Dissipation
57.	Rx Pd	483.845 mW	Power	Total Power Dissipation in Rx1 and Rx2
58.	Snubber Pd	625.704 mW	Power	Snubber Power Dissipation
59.	T1 Pd	349.19 mW	Power	Estimated Losses in Transformer
60.	Total Pd	5.379 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	611.99 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	220.0	Maximum input voltage
3.	VinMin	220.0	Minimum input voltage
4.	Vout	24.0	Output Voltage
5.	line_fsw	50.0	Light Output in Lumen
6.	base_pn	UC2845A	Base Product Number
7.	source	AC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

1. **UC2845A** Product Folder : <http://www.ti.com/product/UC2845A> : contains the data sheet and other resources.

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