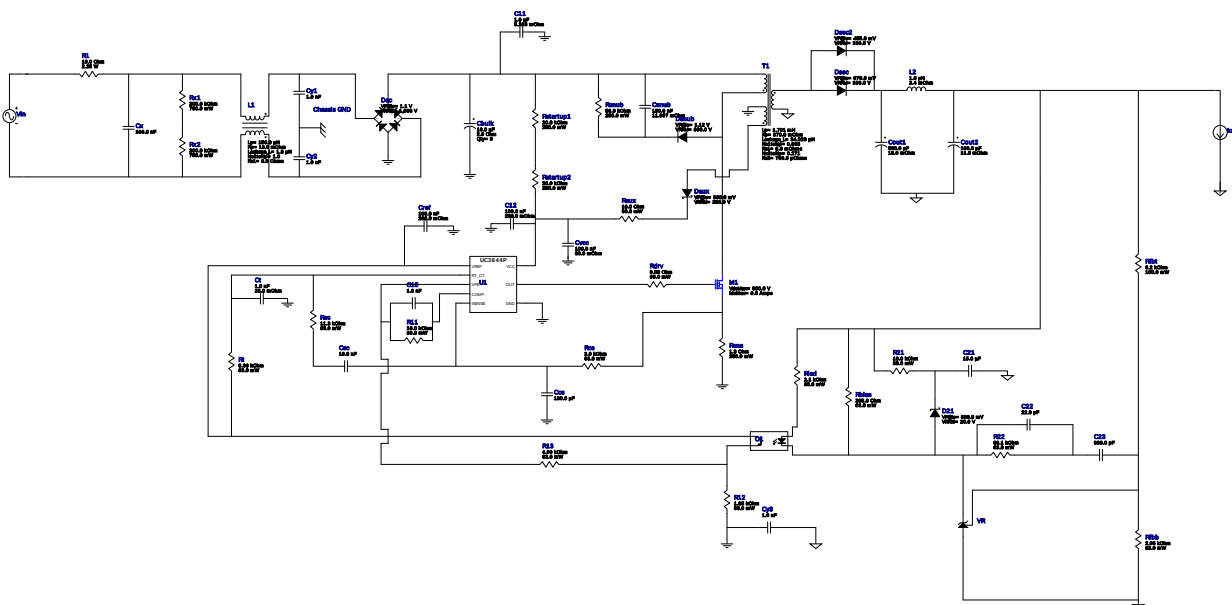


WEBENCH® Design Report

Design : 3893481/11 UC3844N
UC3844N 90.0V-220.0V to 5.00V @ 2.0A



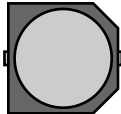
1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.

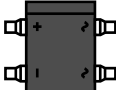
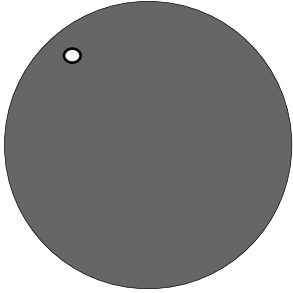
My Comments

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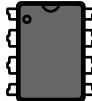
Electrical BOM

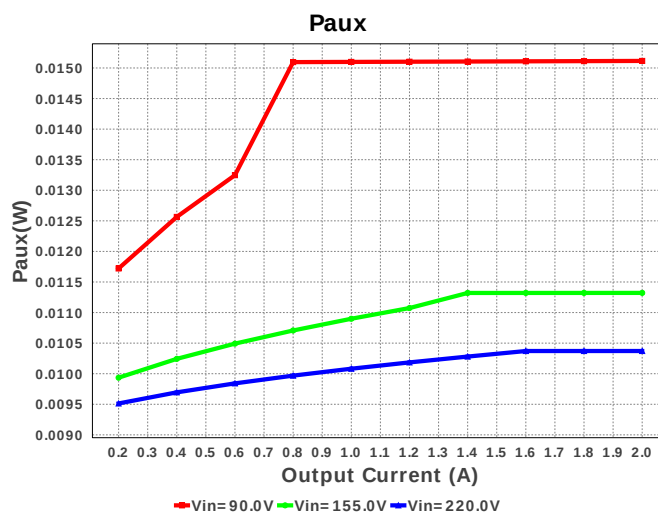
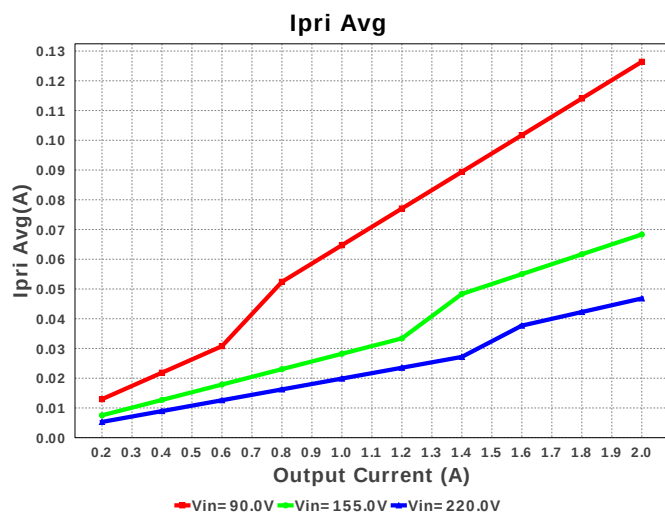
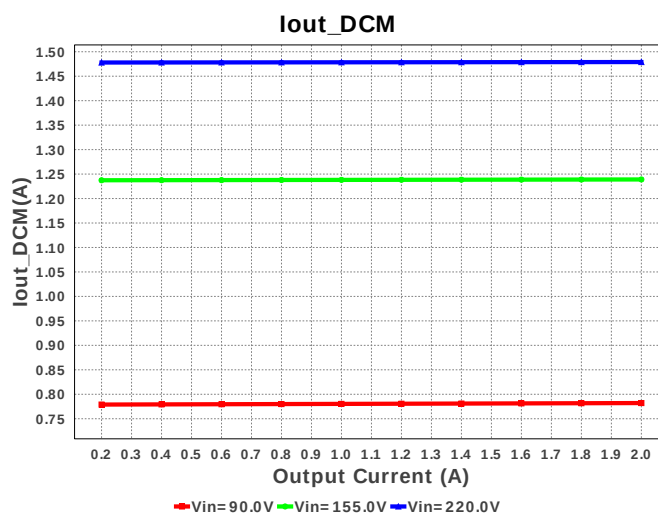
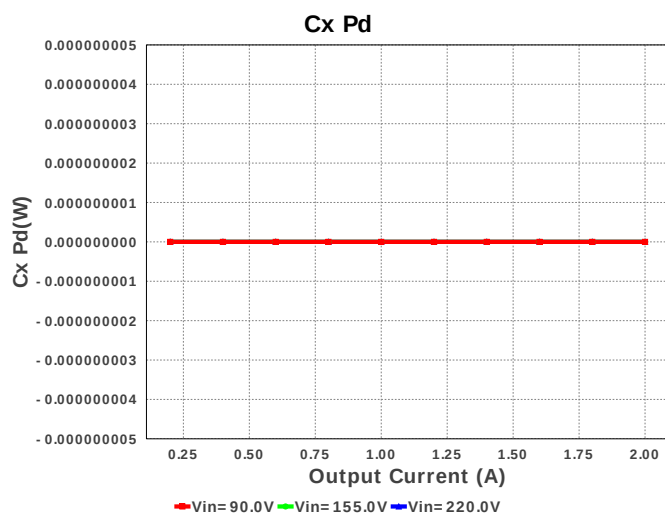
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C11	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	\$1.19	 2220 54 mm ²
2.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
3.	C13	Samsung 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	MuRata	KCM55WR72A156MH01K Series= X7R	Cap= 15.0 uF VDC= 100.0 V IRMS= 0.0 A	1	\$1.51	 KCM55W 59 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	CC0805KRX7R9BB681 Series= X7R	Cap= 680.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
7.	Cbulk	Kemet	ESG106M400AH4AA Series= 2334	Cap= 10.0 uF ESR= 2.9 Ohm VDC= 400.0 V IRMS= 100.0 mA	3	\$0.19	 ESG106 144 mm ²

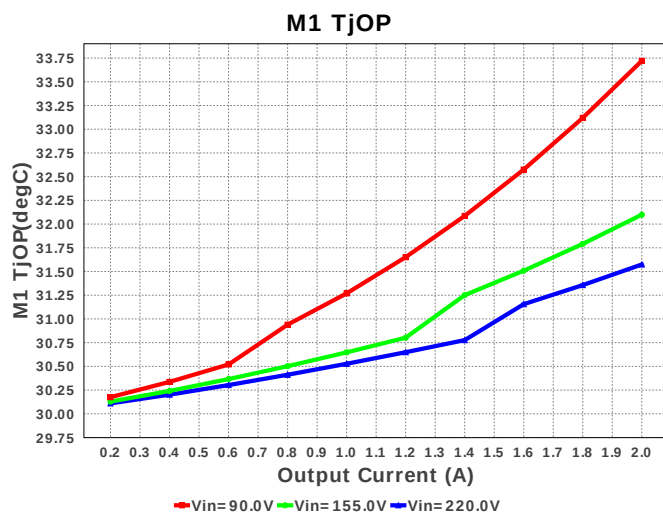
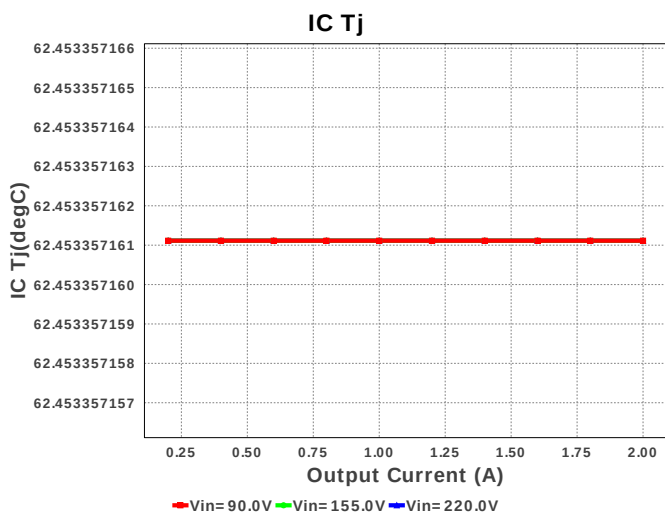
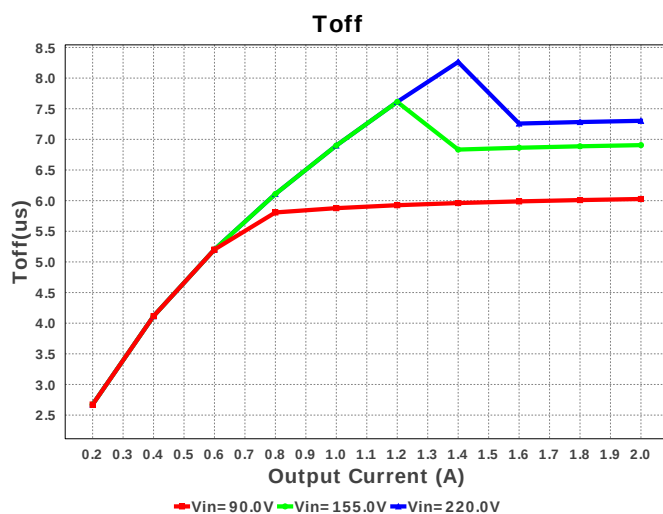
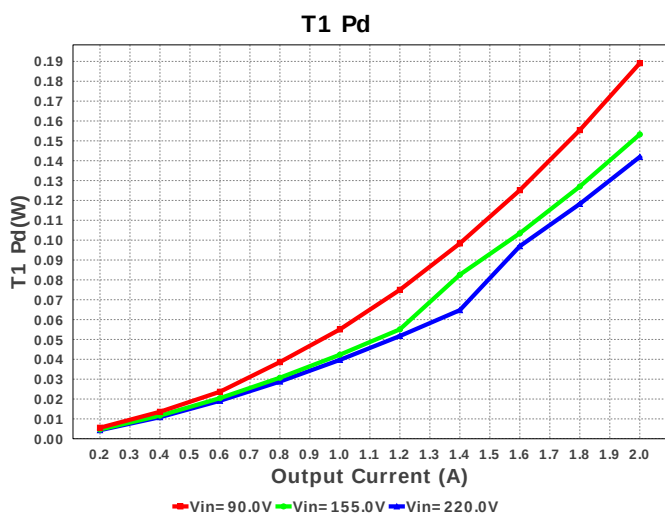
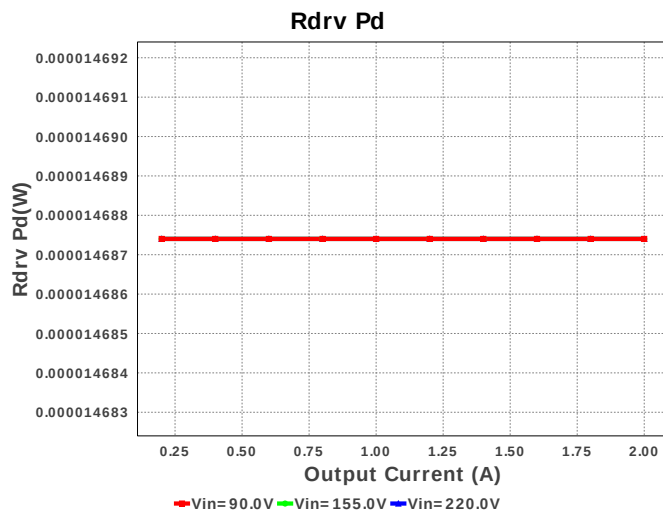
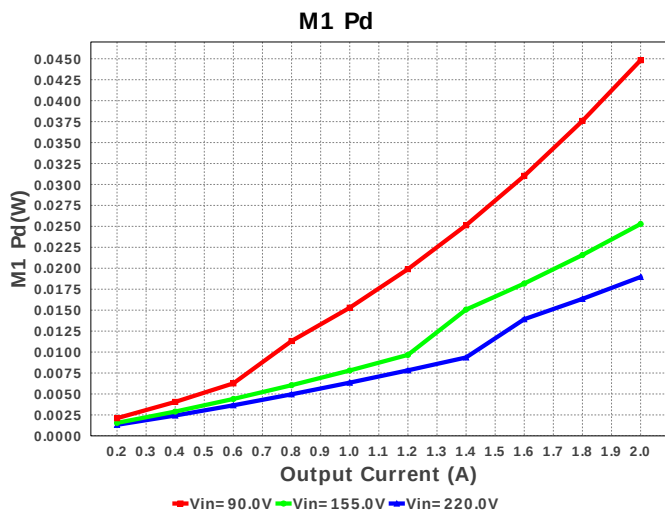
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Ccs	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
9.	Cout1	Panasonic	16SVP330M Series= SVP	Cap= 330.0 uF ESR= 16.0 mOhm VDC= 16.0 V IRMS= 4.72 A	1	\$0.39	 SM_RADIAL_10AMM 160 mm ²
10.	Cout2	Panasonic	16SVPE180M Series= SVPE	Cap= 180.0 uF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 4.46 A	1	\$0.49	 CAPSMT_62_C10 74 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	C3225X7T2J154K Series= X7T	Cap= 150.0 nF ESR= 11.907 mOhm VDC= 630.0 V IRMS= 0.0 A	1	\$0.19	 1210 15 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

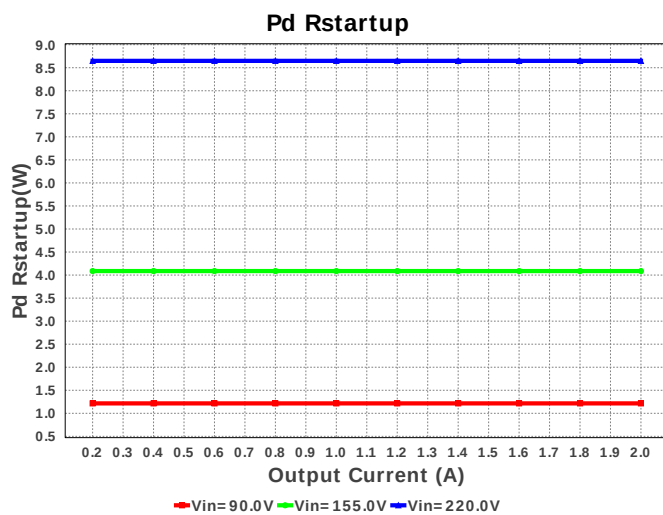
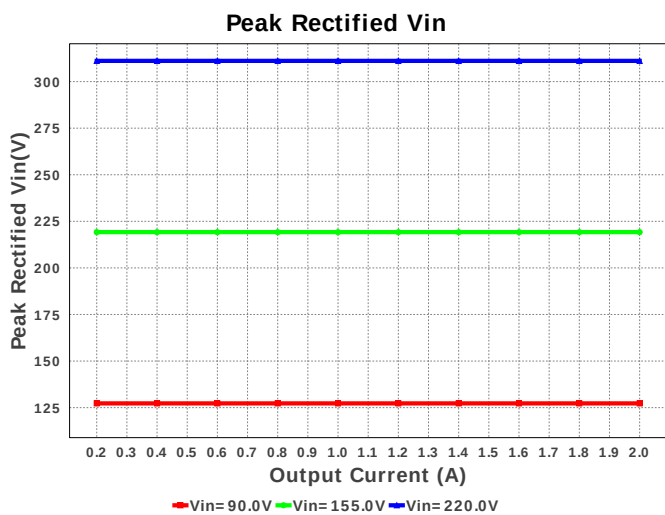
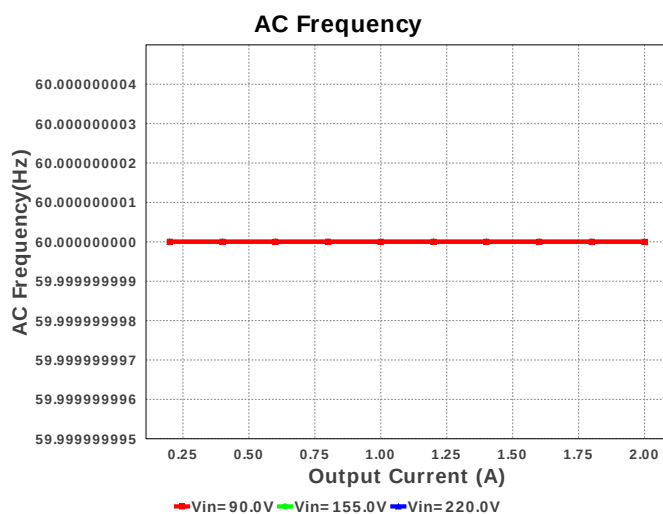
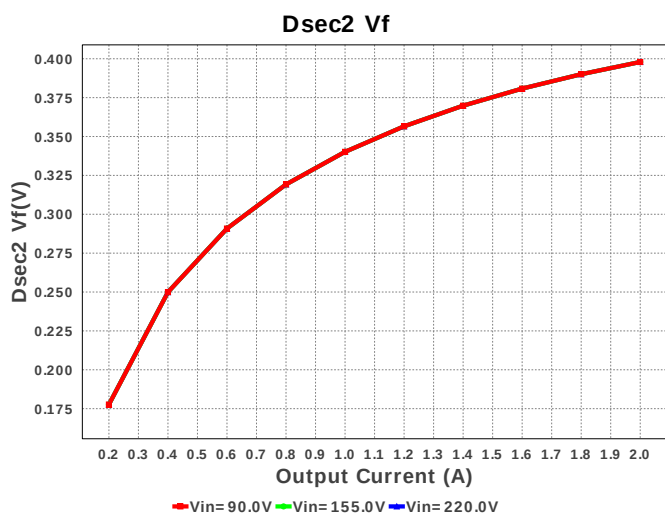
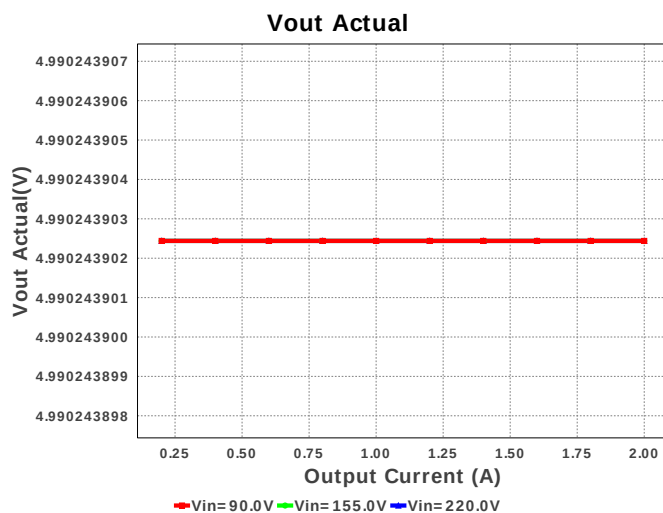
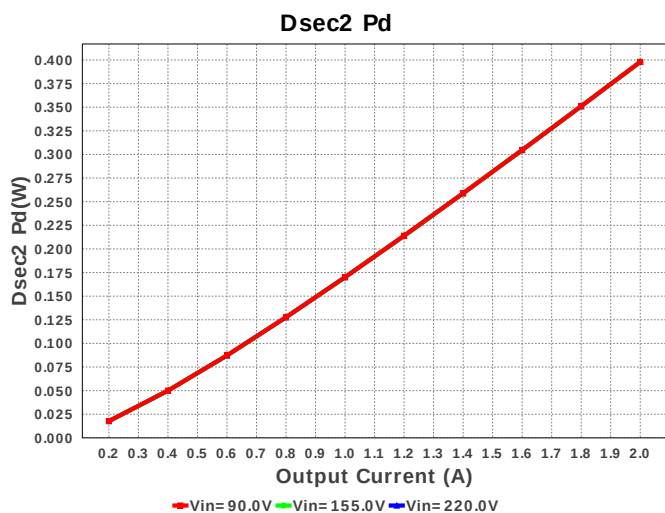
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
19.	Cy3	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm ²
20.	D21	Vishay-Semiconductor	SS12-E3/61T	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMA 37 mm ²
21.	Dac	Vishay-Semiconductor	DF10SA	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	Fairchild Semiconductor	FSV8100V	VF@Io= 670.0 mV VRRM= 100.0 V	1	\$0.21	 TO-277A 56 mm ²
24.	Dsec2	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	\$1.33	 DDPAK 210 mm ²
25.	Dsnub	Bourns	CD214C-F3600	VF@Io= 1.12 V VRRM= 600.0 V	1	\$0.18	 SMC 83 mm ²
26.	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
27.	L2	Coilcraft	SER1360-182KLB	L= 1.8 µH DCR= 2.4 mOhm	1	\$0.72	 SER1360 225 mm ²
28.	M1	Fairchild Semiconductor	FDD6N50TM	VdsMax= 500.0 V IdsMax= 6.0 Amps	1	\$0.47	 DPAK 102 mm ²
29.	O1	Vishay-Semiconductor	TCMT1109	Optocoupler	1	\$0.21	 SOP-4 44 mm ²

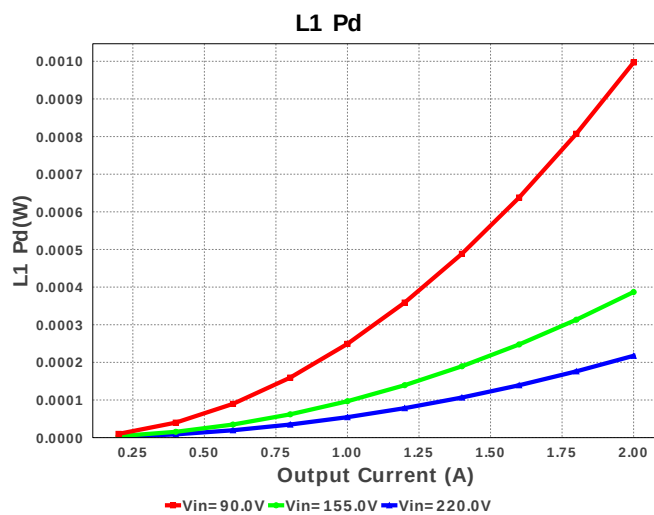
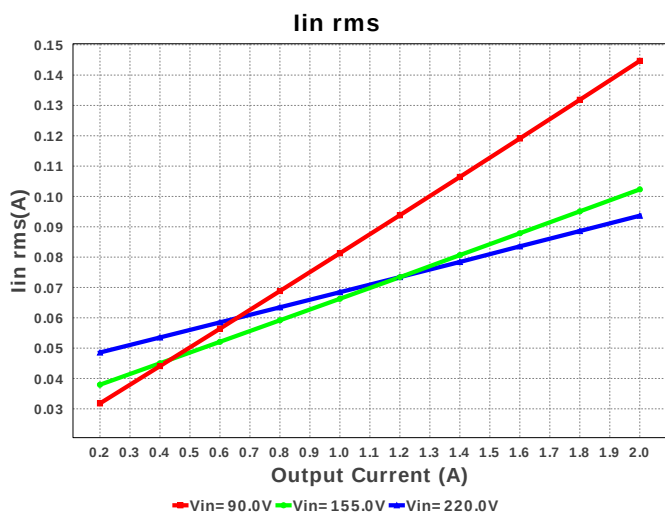
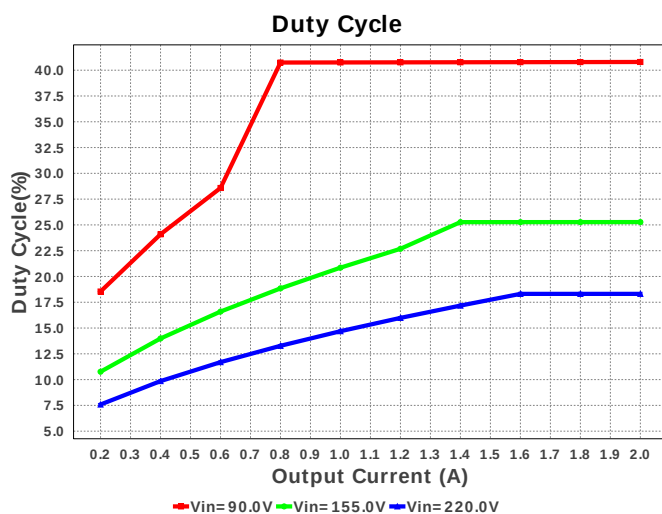
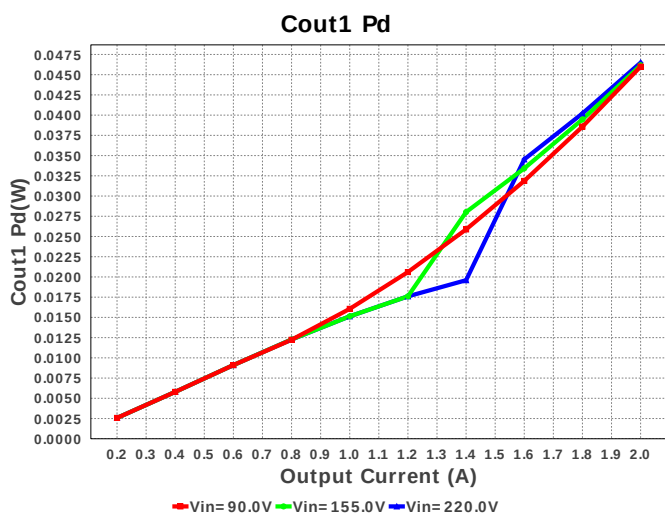
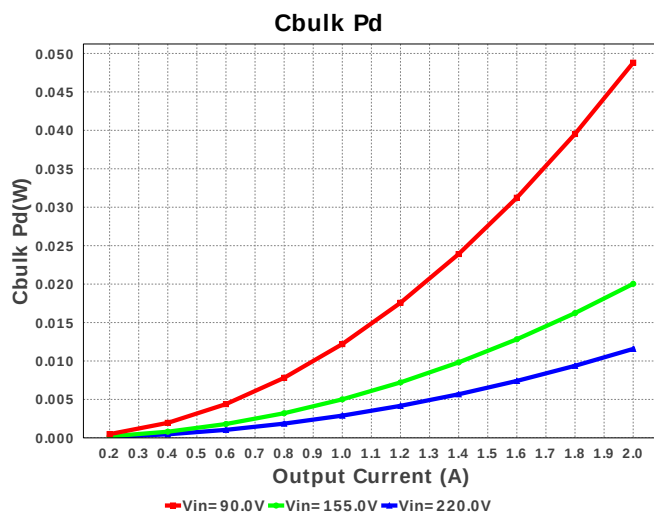
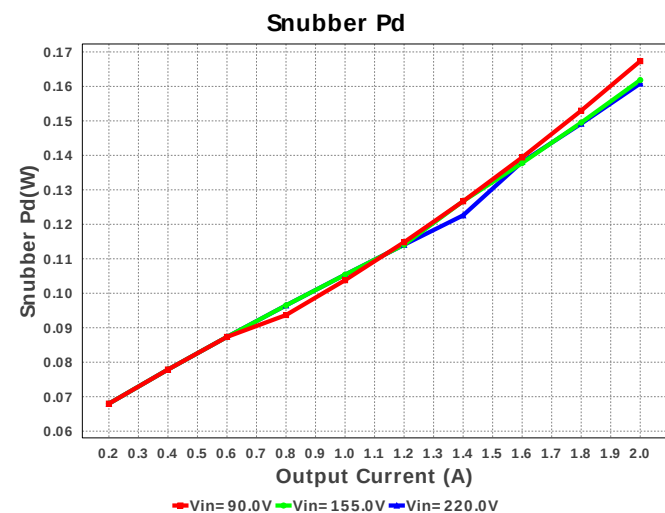
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
30.	R1	Vishay-Dale	AC03000001009JACCS Series= F_RES	Res= 10.0 Ohm Power= 2.25 W Tolerance= 5.0%	1	\$0.30	 AC03 158 mm²
31.	R11	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
32.	R12	Vishay-Dale	CRCW04021K65FKED Series= CRCW..e3	Res= 1.65 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
33.	R13	Vishay-Dale	CRCW04024K99FKED Series= CRCW..e3	Res= 4.99 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
34.	R21	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
35.	R22	Vishay-Dale	CRCW040268K1FKED Series= CRCW..e3	Res= 68.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
36.	Raux	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
37.	Rbias	Vishay-Dale	CRCW0402205RFBKED Series= CRCW..e3	Res= 205.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
38.	Rcs	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
39.	Rdrv	Vishay-Dale	CRCW04029R09FKED Series= CRCW..e3	Res= 9.09 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
40.	Rfbb	Vishay-Dale	CRCW04022K05FKED Series= CRCW..e3	Res= 2.05 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
41.	Rfbt	Yageo America	RC0603FR-076K2L Series= ?	Res= 6.2 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm²
42.	Rled	Vishay-Dale	CRCW04022K10FKED Series= CRCW..e3	Res= 2.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
43.	Rsc	Vishay-Dale	CRCW040211K3FKED Series= CRCW..e3	Res= 11.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
44.	Rsns	Yageo America	RC1206FR-071R8L Series= ?	Res= 1.8 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
45.	Rsnub	Yageo America	RC1206FR-0756KL Series= ?	Res= 56.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
46.	Rstartup1	Panasonic	ERJ-8ENF2002V Series= ERJ-8E	Res= 20.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
47.	Rstartup2	Panasonic	ERJ-8ENF2002V Series= ERJ-8E	Res= 20.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
48.	Rt	Vishay-Dale	CRCW04028K66FKED Series= CRCW..e3	Res= 8.66 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
49.	Rx1	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm²
50.	Rx2	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm²

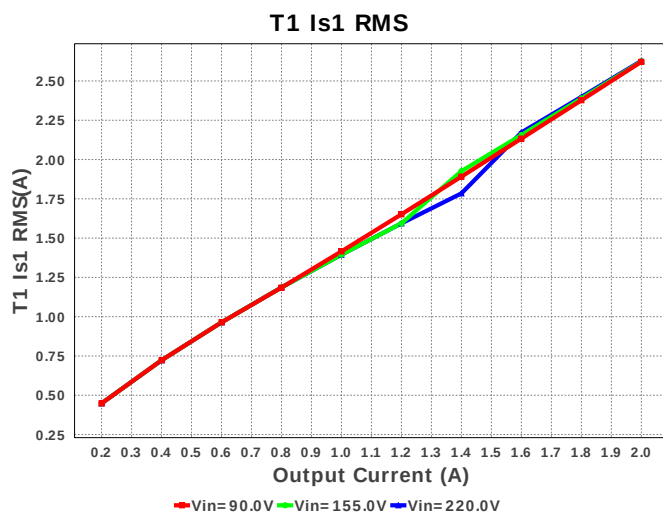
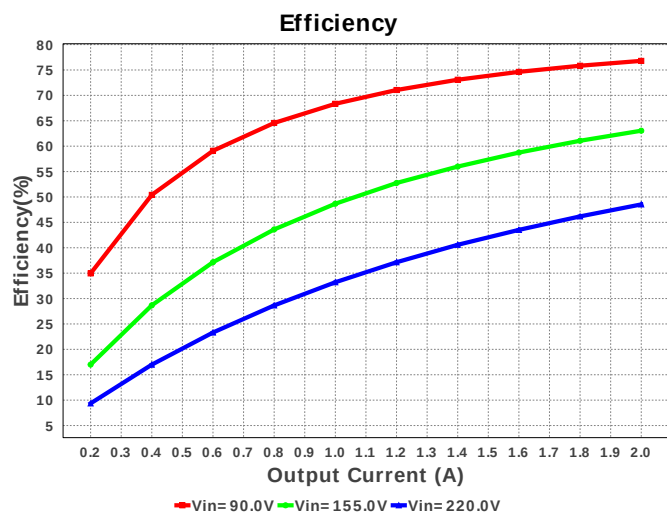
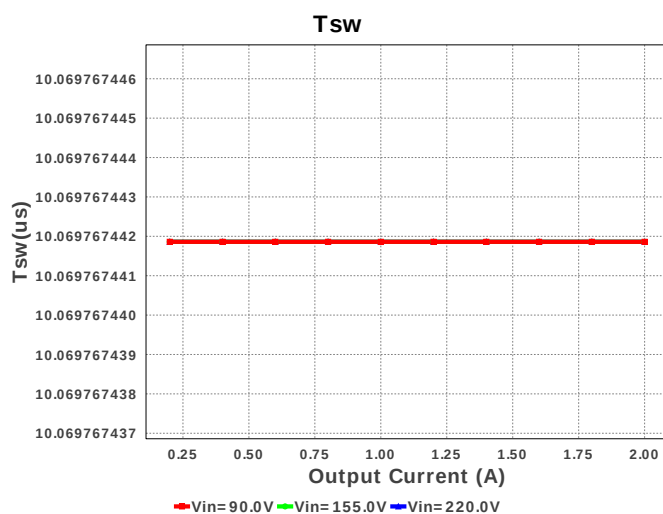
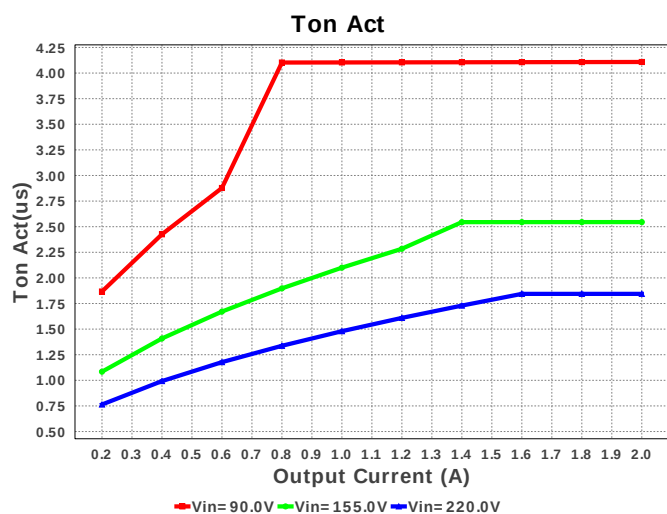
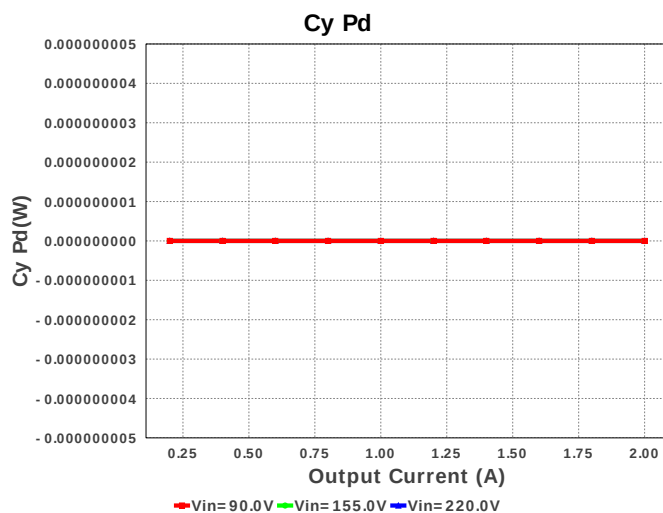
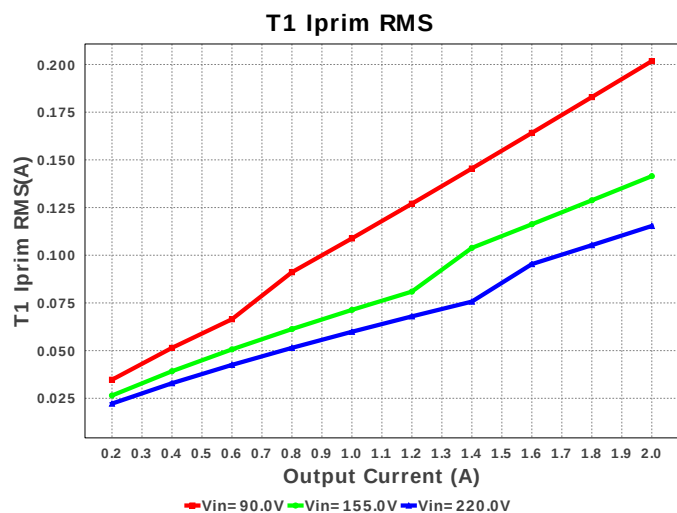
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
51. T1		CUSTOM	CUSTOM	Lp= 1.701 mH Rp= 870.0 mOhm Leakage_L= 34.023 μ H Ns1toNp= 0.093 Rs1= 8.6 mOhms Ns2toNp= 0.271 Rs2= 700.0 μ Ohms	1	NA	CUSTOM 0 mm ²
52. U1		Texas Instruments	UC3844N	Switcher	1	\$0.56	 P0008A 116 mm ²
53. VR		Texas Instruments	LMV431CM5/NOPB	Voltage References	1	\$0.16	 R-PDSO-G3 16 mm ²

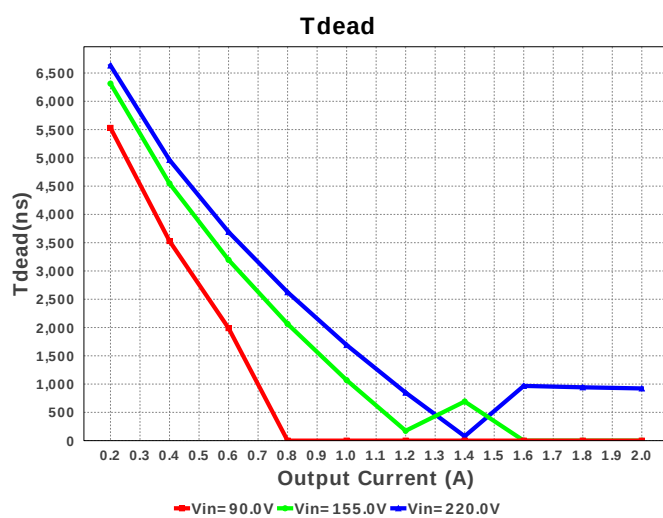
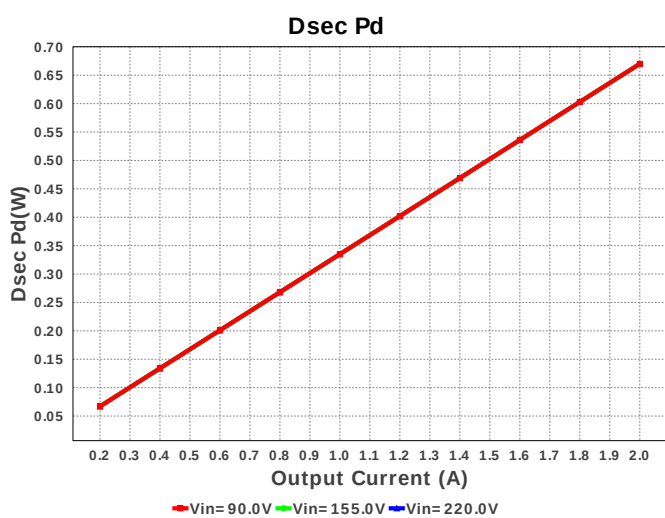
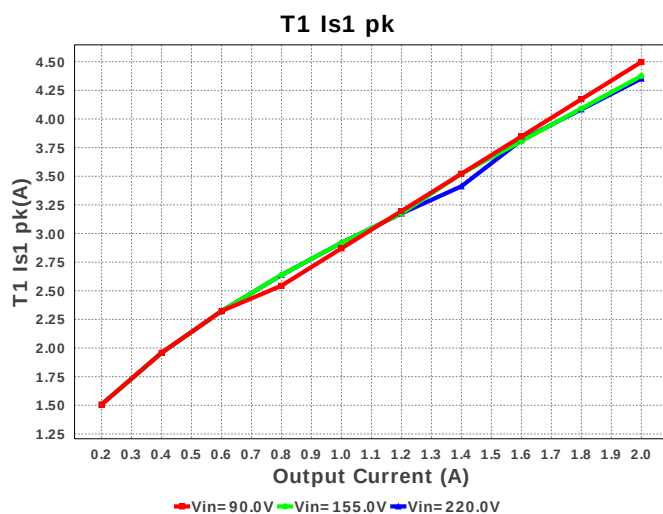
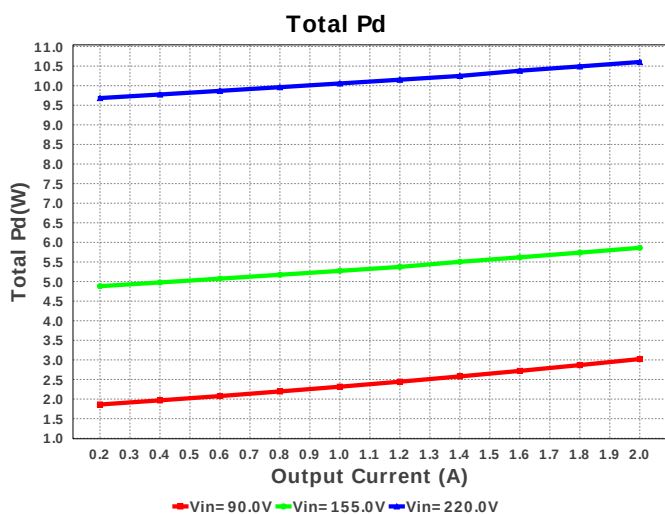
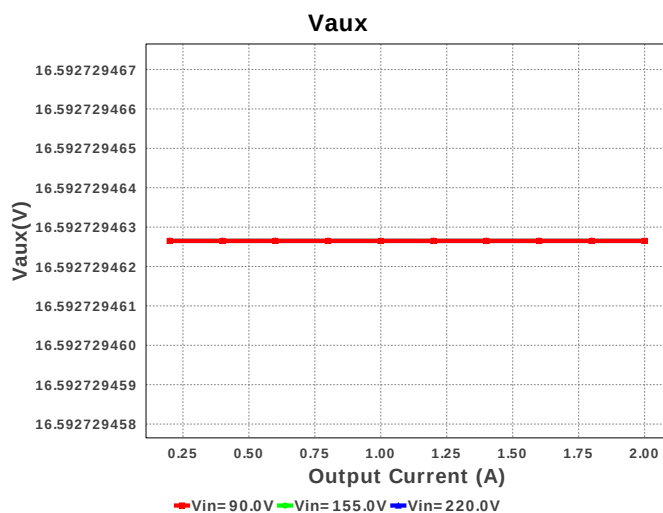
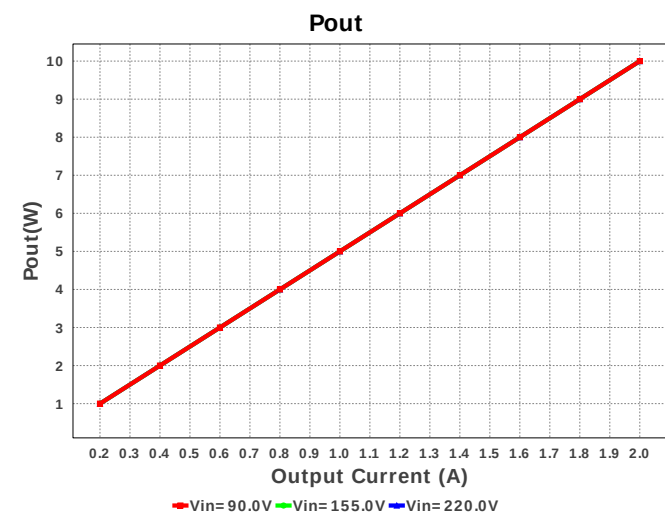




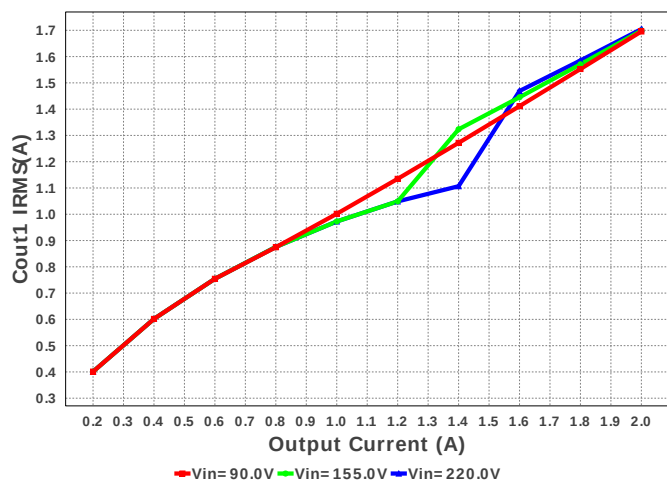




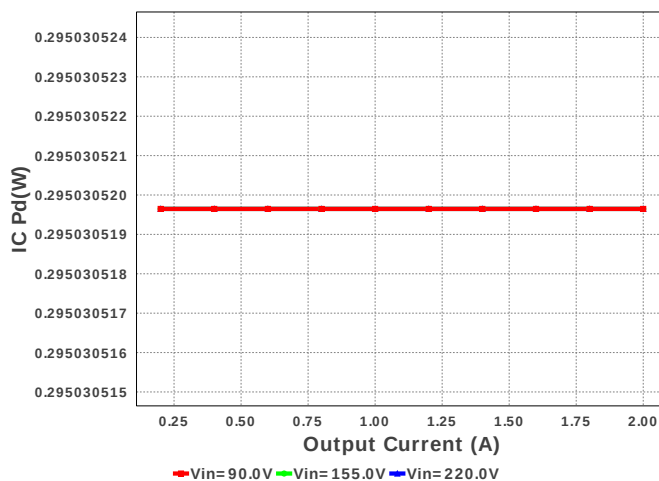




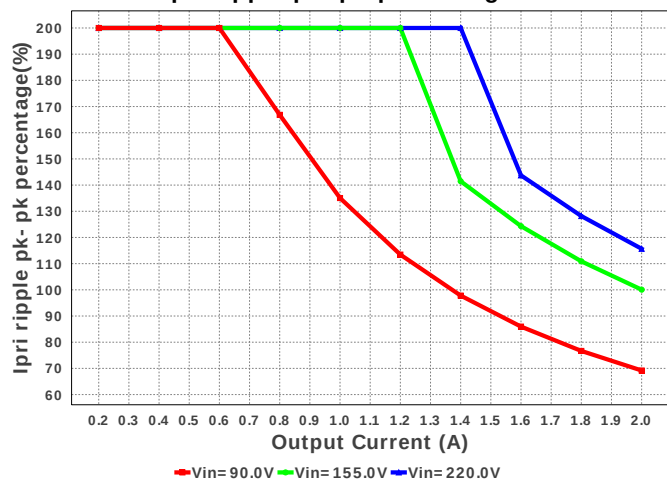
Cout1 IRMS



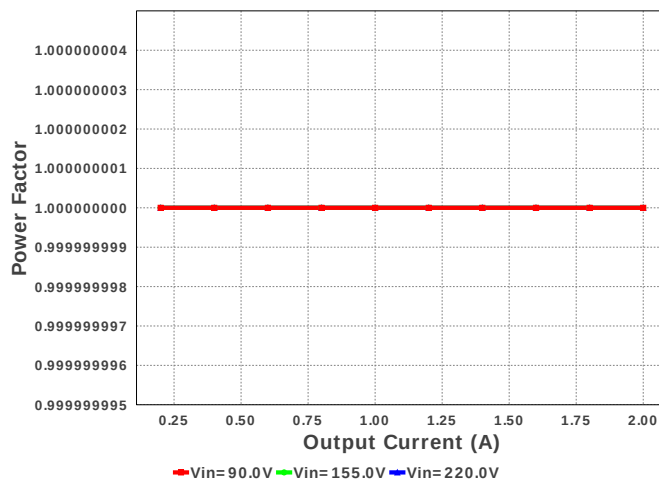
IC Pd



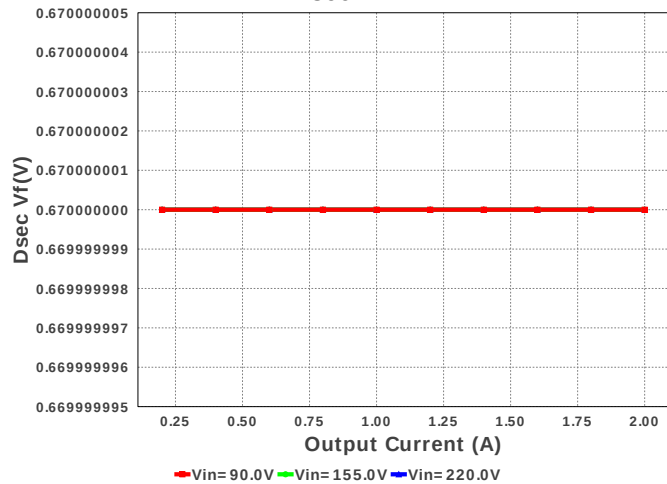
Ipri ripple pk- pk percentage



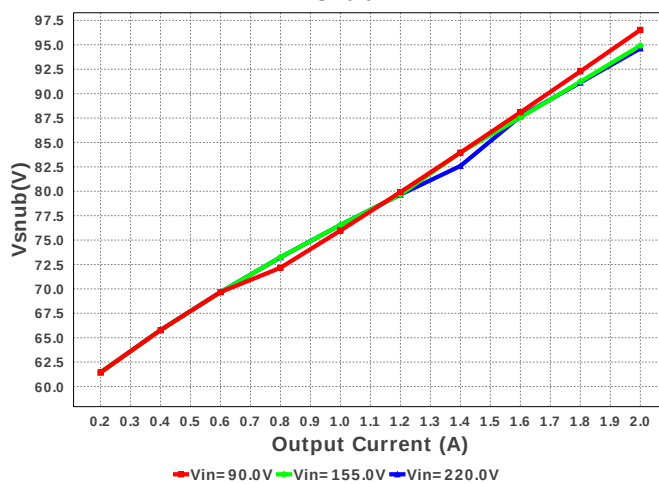
Power Factor

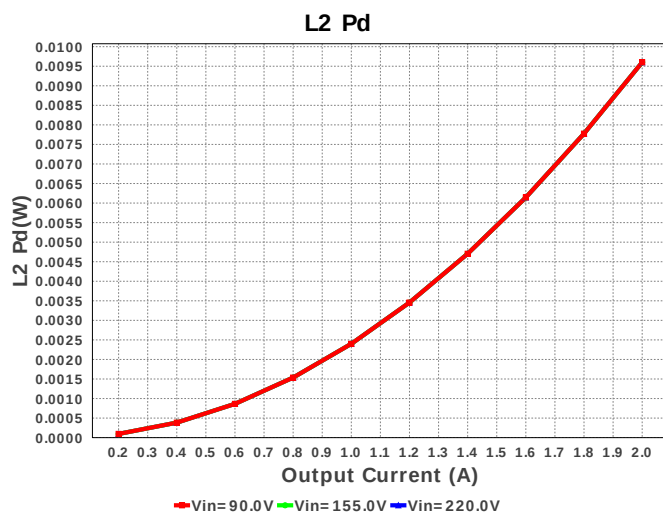
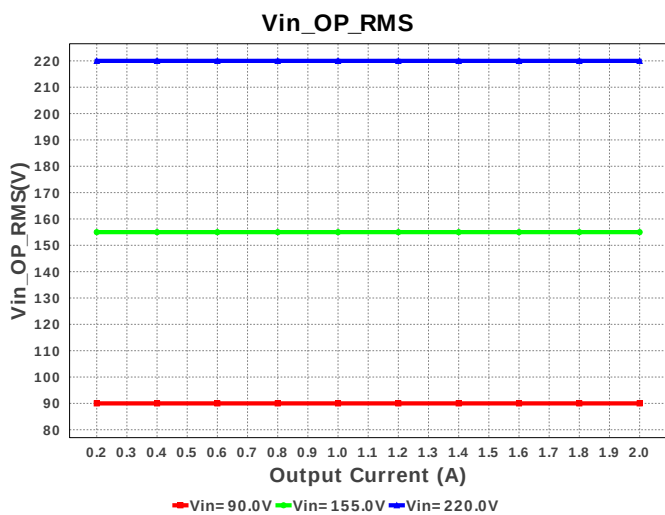
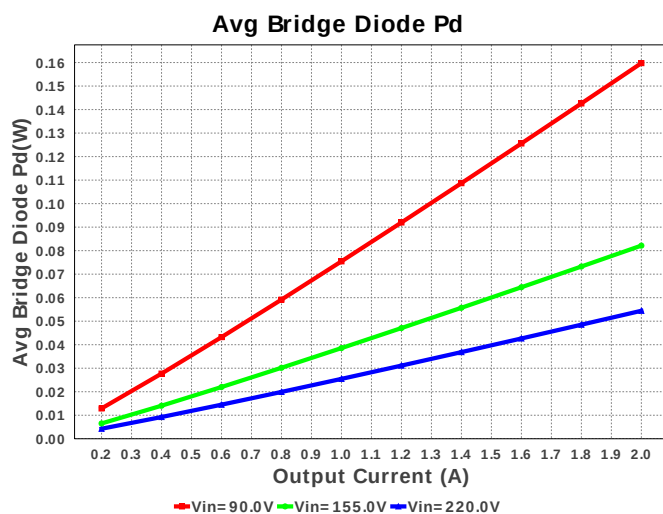
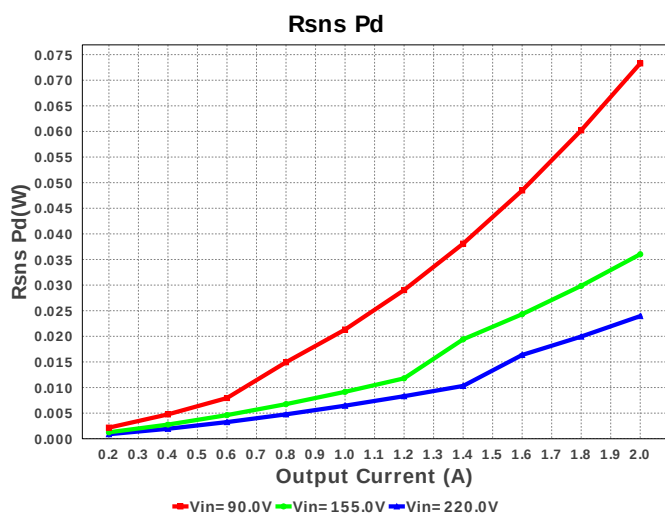
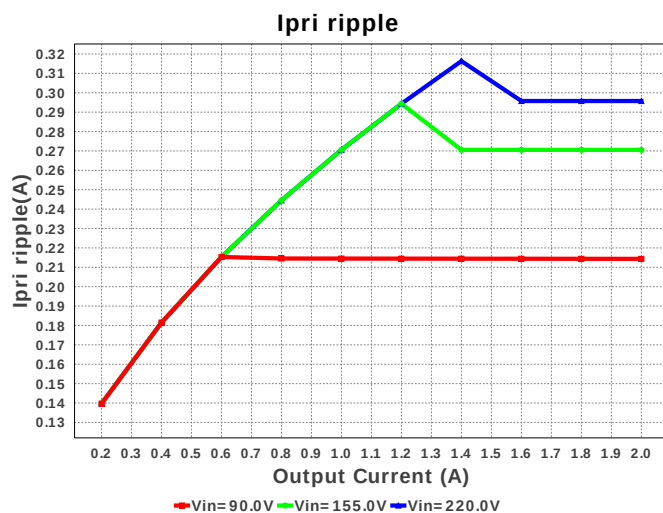
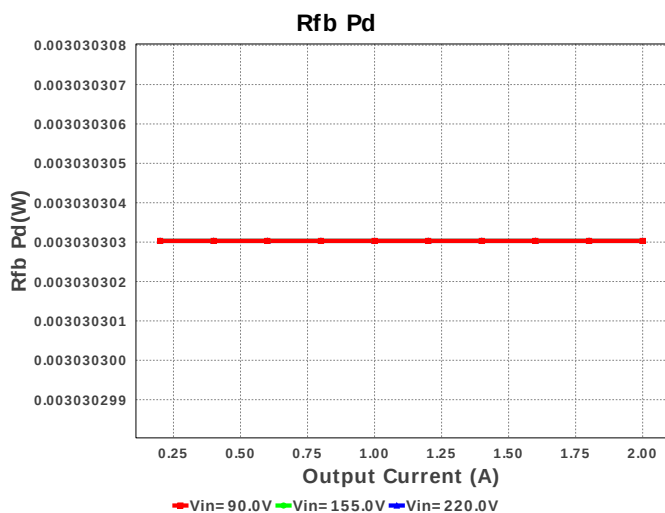


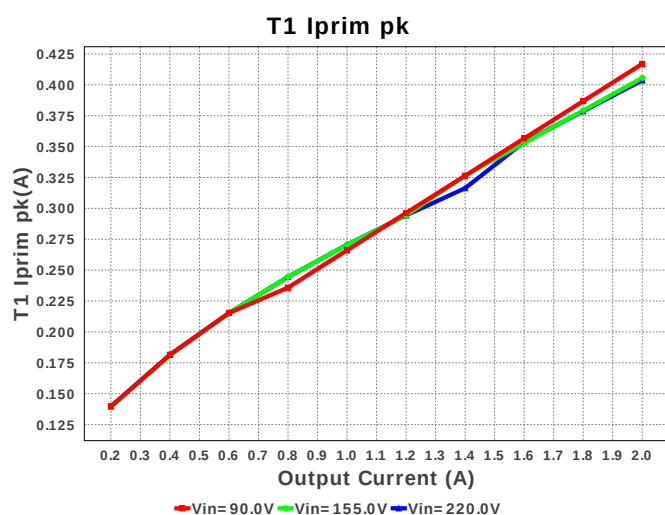
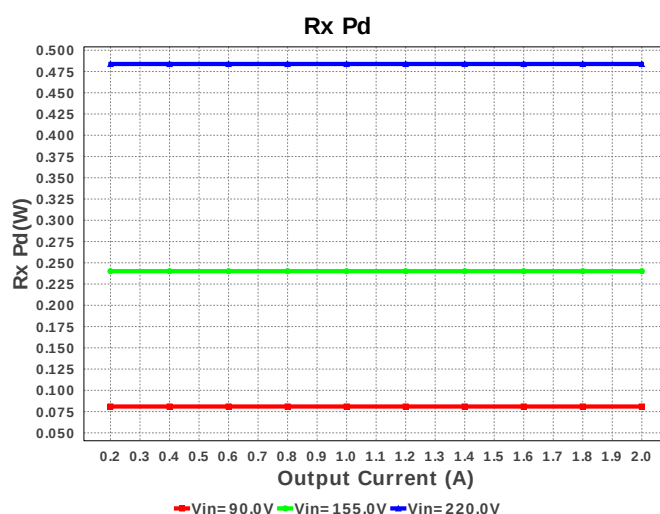
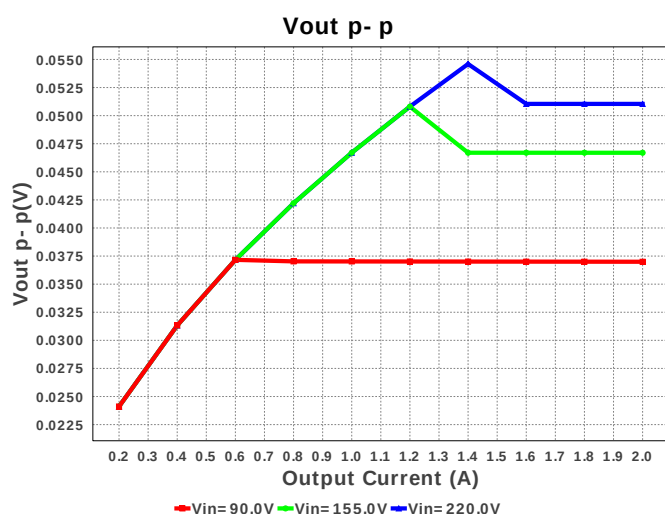
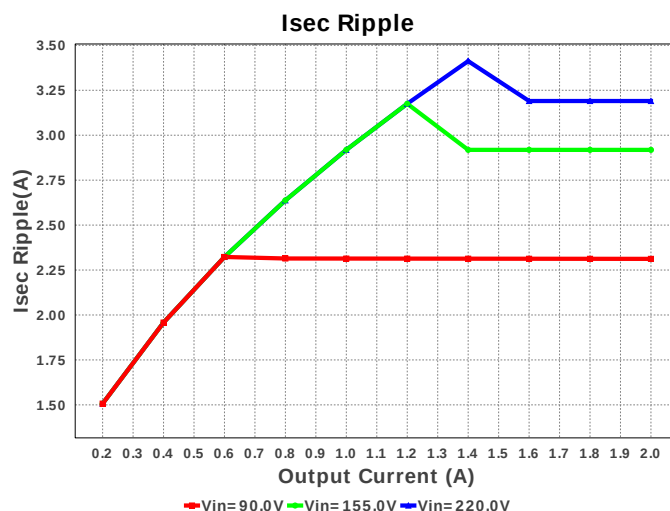
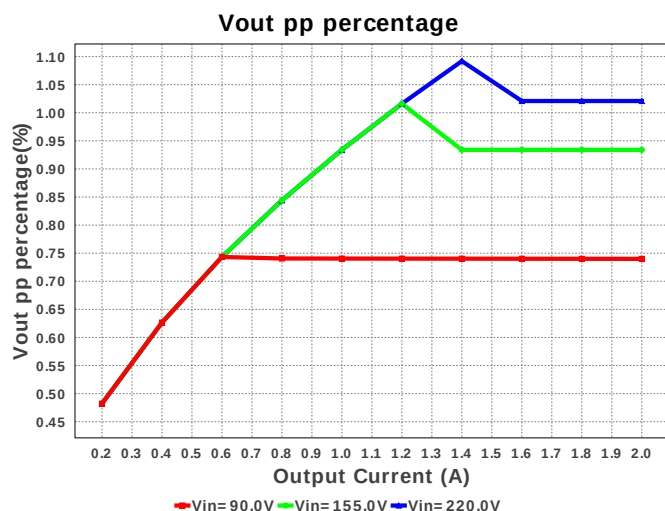
Dsec Vf



Vsusb







Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	1.696 A	Current	Output capacitor1 RMS ripple current
2.	Iin rms	144.69 mA	Current	RMS Input Current
3.	Iout_DCM	782.056 mA	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	126.384 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	214.343 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	69.19 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	2.312 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	201.777 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	416.958 mA	Current	Transformer Primary Peak Current

#	Name	Value	Category	Description
10.	T1 Is1 RMS	2.622 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	4.498 A	Current	Transformer Secondary1 Peak Current
12.	AC Frequency	60.0 Hz	General	Input AC frequency
13.	BOM Count	55	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	397.923 mV	General	Effective Forward Voltage Drop at the Operating Current
18.	Dsnub trr	30.0 ns	General	Snubber Diode Reverse Recovery Time
19.	FootPrint	3.844 k mm ²	General	Total Foot Print Area of BOM components
20.	Frequency	99.307 kHz	General	Switching frequency
21.	Pout	10.0 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	6.027 us	General	Approximate Converter Off Time
25.	Ton Act	4.108 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	16.593 V	General	Auxiliary Voltage
29.	Vsnub	96.532 V	General	Voltage Across the Snubber
30.	Vout Actual	4.99 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
31.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
32.	Duty Cycle	40.797 %	Op_point	Duty cycle
33.	Efficiency	76.795 %	Op_point	Steady state efficiency
34.	IC Tj	62.453 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	33.721 degC	Op_point	M1 MOSFET junction temperature
38.	Peak Rectified Vin	127.278 V	Op_point	Peak voltage seen at rectified input
39.	Vin_OP_RMS	90.0 V	Op_point	AC Input RMS Voltage
40.	Vout p-p	36.994 mV	Op_point	Peak-to-peak output ripple voltage
41.	Avg Bridge Diode Pd	159.746 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
42.	Cbulk Pd	48.799 mW	Power	Bulk capacitor power dissipation
43.	Cout1 Pd	46.0 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	670.0 mW	Power	Secondary Diode Power Dissipation
47.	Dsec2 Pd	397.923 mW	Power	Secondary Diode Power Dissipation
48.	IC Pd	295.031 mW	Power	IC power dissipation
49.	L1 Pd	996.91 μW	Power	Power Dissipation in the Inductor
50.	L2 Pd	9.6 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
51.	M1 Pd	44.827 mW	Power	M1 MOSFET total power dissipation
52.	Paux	15.115 mW	Power	Power Dissipation in Raux and Daux
53.	Pd Rstartup	1.215 W	Power	Power Dissipation in Rstartup1 and Rstartup2
54.	Rdrv Pd	14.687 μW	Power	Power Dissipation in Gate Drive Resistor
55.	Rfb Pd	3.03 mW	Power	Rfb Power Dissipation
56.	Rsns Pd	73.285 mW	Power	Current Limit Sense Resistor Power Dissipation
57.	Rx Pd	80.974 mW	Power	Total Power Dissipation in Rx1 and Rx2
58.	Snubber Pd	167.339 mW	Power	Snubber Power Dissipation
59.	T1 Pd	189.093 mW	Power	Estimated Losses in Transformer
60.	Total Pd	3.022 W	Power	Total Power Dissipation
61.	Vout Tolerance	2.173 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
62.	Vout pp percentage	739.888 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	90.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	acFrequency	60.0	Light Output in Lumen
6.	base_pn	UC3844	Texas Instruments Base Part Number
7.	source	AC	Input Source Type
8.	ta	30.0	Ambient temperature

Design Assistance

1. UC3844 Product Folder : <http://www.ti.com/product/UC3844> : contains the data sheet and other resources.

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