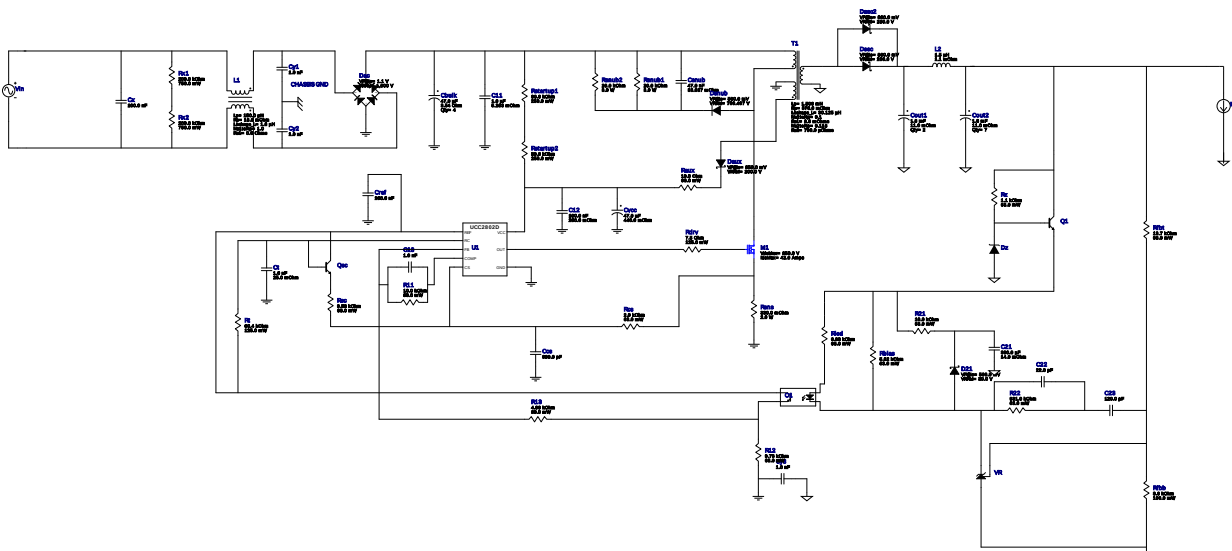


WEBENCH® Design Report

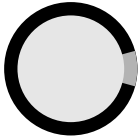
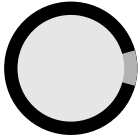
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UCC2802DTR 85.0V-265.0V to 12.00V @ 5.0A

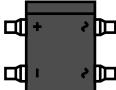
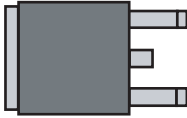
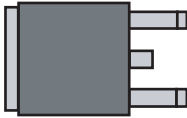
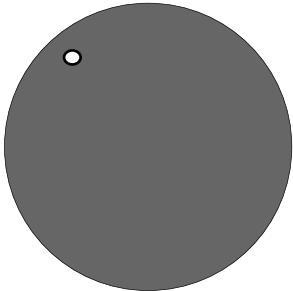
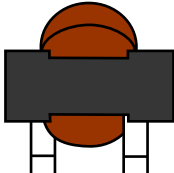


1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.

Electrical BOM

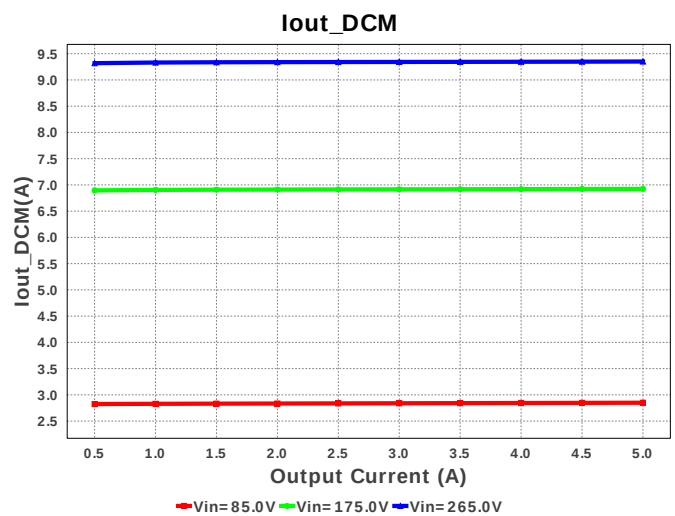
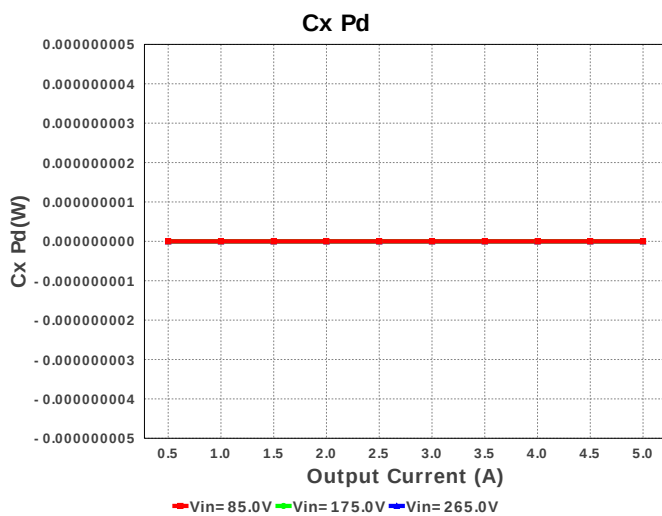
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C11	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	\$1.19	 2220 54 mm ²
2.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
3.	C13	MuRata	GRM033R71C102KA01D Series= X7R	Cap= 1.0 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²
4.	C21	Panasonic	20SVPF390M Series= ?	Cap= 390.0 uF ESR= 14.0 mOhm VDC= 20.0 V IRMS= 4.95 A	1	\$0.63	 CAPSMT_62_E12 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	CL21C121JB61PNC Series= C0G/NP0	Cap= 120.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
7.	Cbulk	Vishay-Bccomponents	MAL215759479E3 Series= 2239	Cap= 47.0 uF ESR= 3.54 Ohm VDC= 500.0 V IRMS= 680.0 mA	4	\$2.68	157PUM-SI_2200x2500 576 mm ²
8.	Ccs	MuRata	GRM033R71C681KA01D Series= X7R	Cap= 680.0 pF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²

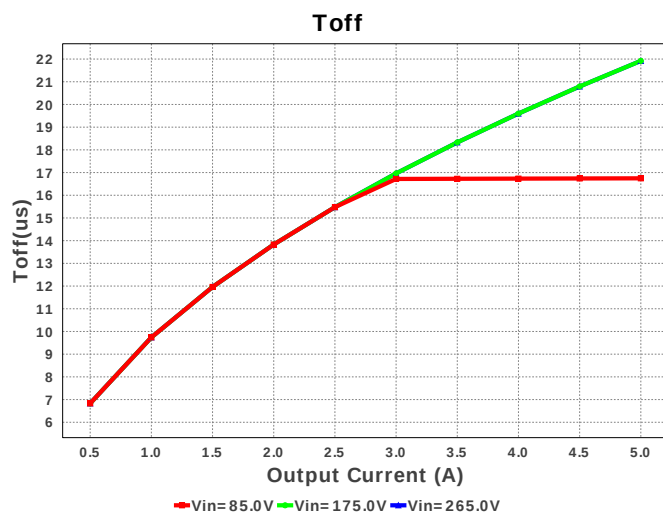
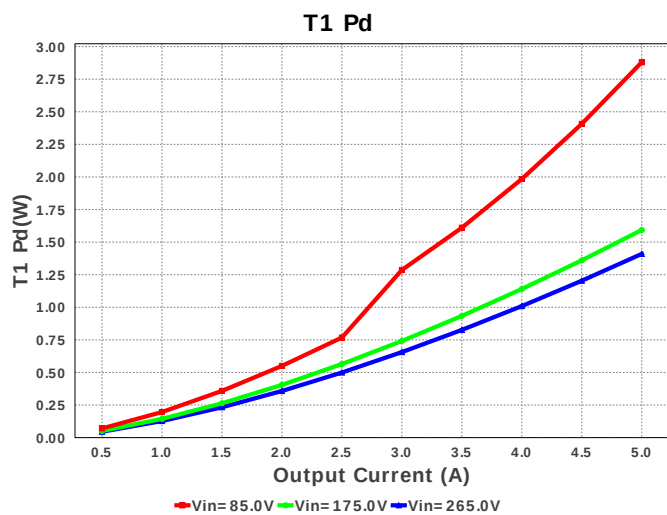
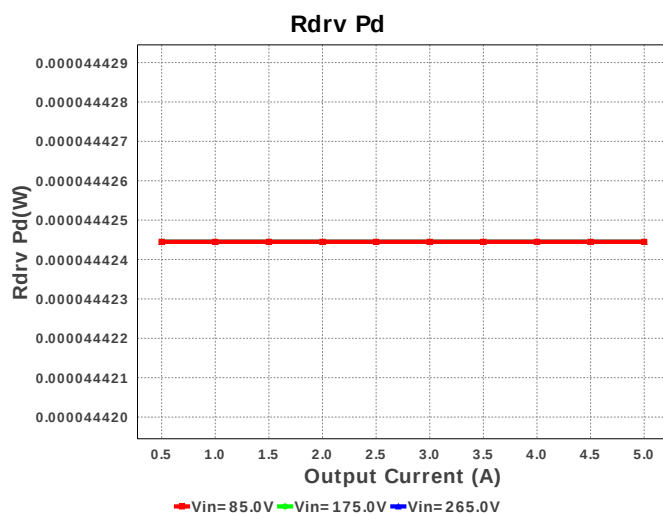
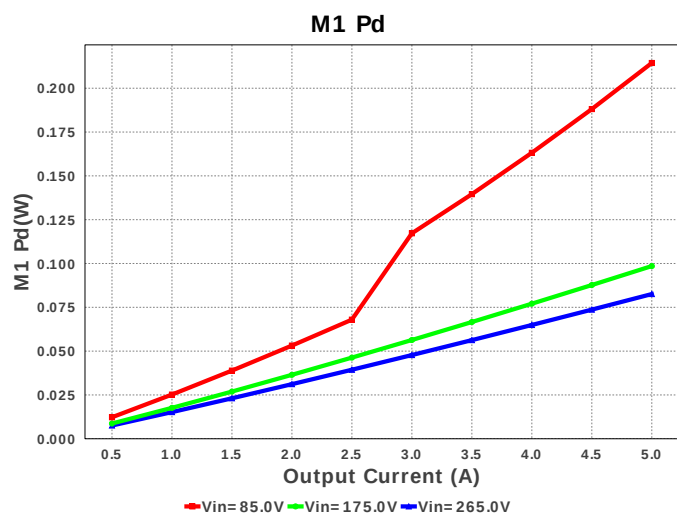
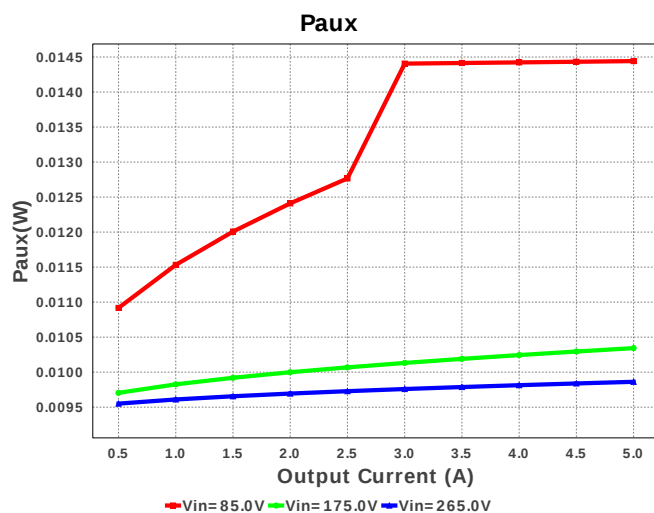
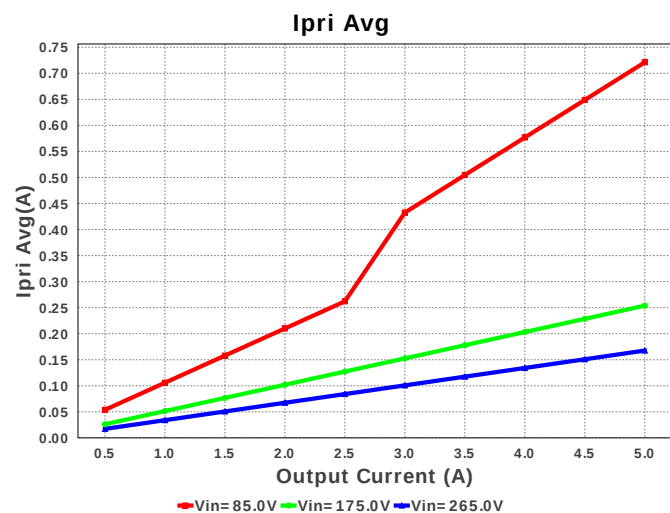
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cout1	Nichicon	UHV1V182MHD Series= HV	Cap= 1.8 mF ESR= 11.0 mOhm VDC= 35.0 V IRMS= 3.925 A	2	NA	 CAPPR5-12.5X25 210 mm ²
10.	Cout2	Nichicon	UHV1V182MHD Series= HV	Cap= 1.8 mF ESR= 11.0 mOhm VDC= 35.0 V IRMS= 3.925 A	7	NA	 CAPPR5-12.5X25 210 mm ²
11.	Cref	MuRata	GRM155R61C104KA88D Series= X5R	Cap= 100.0 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
12.	Csnub	TDK	C3216X5R2E473K Series= X5R	Cap= 47.0 nF ESR= 33.037 mOhm VDC= 250.0 V IRMS= 0.0 A	1	\$0.04	 1206 11 mm ²
13.	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
14.	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
15.	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
16.	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
17.	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

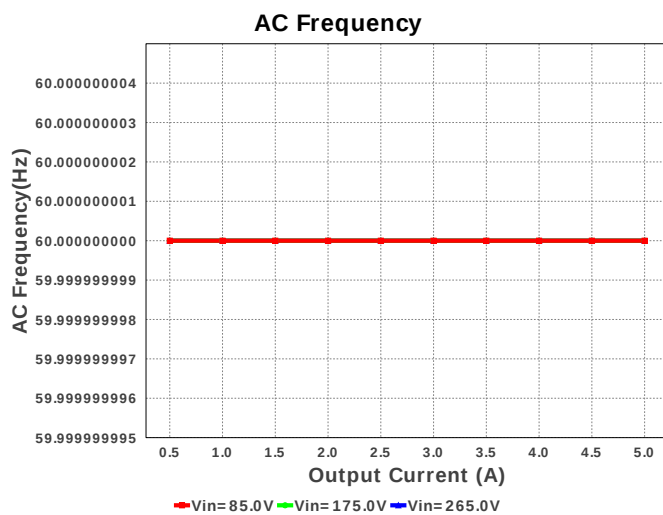
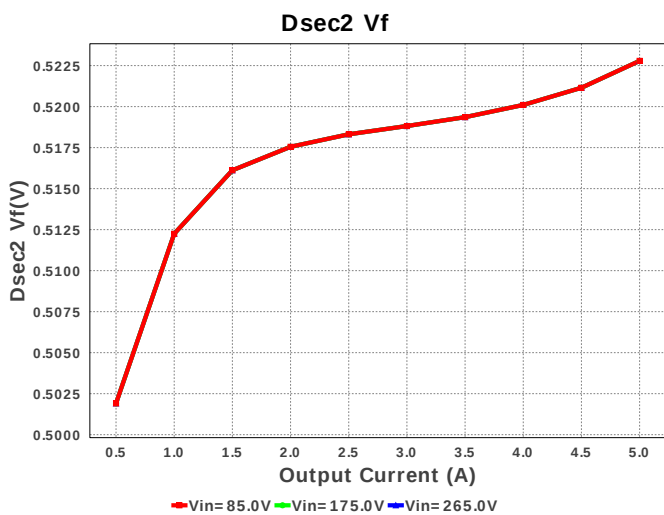
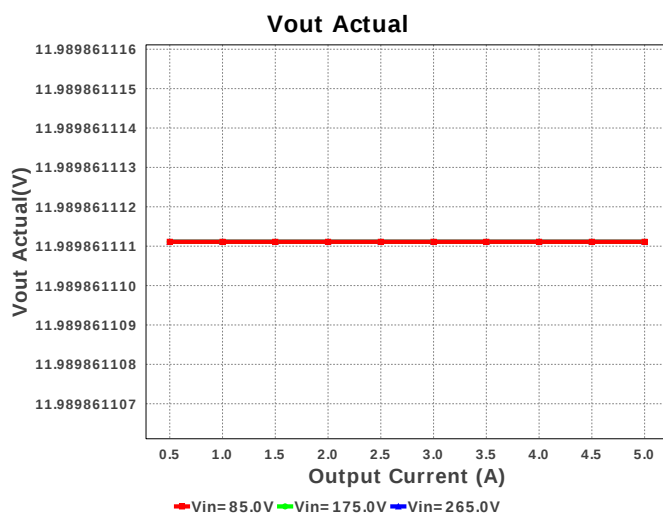
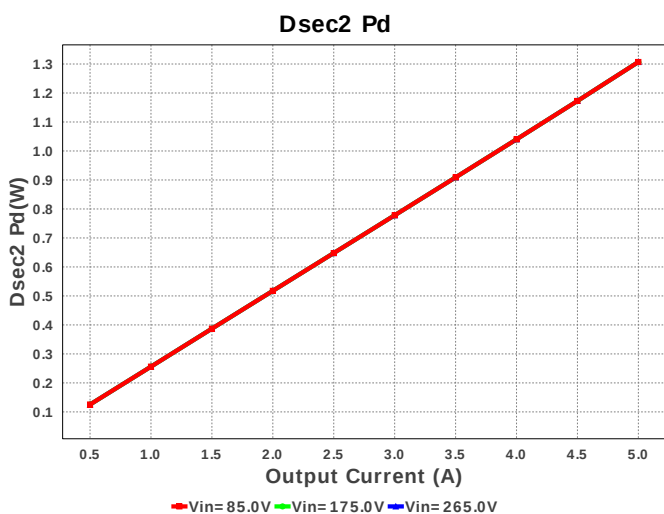
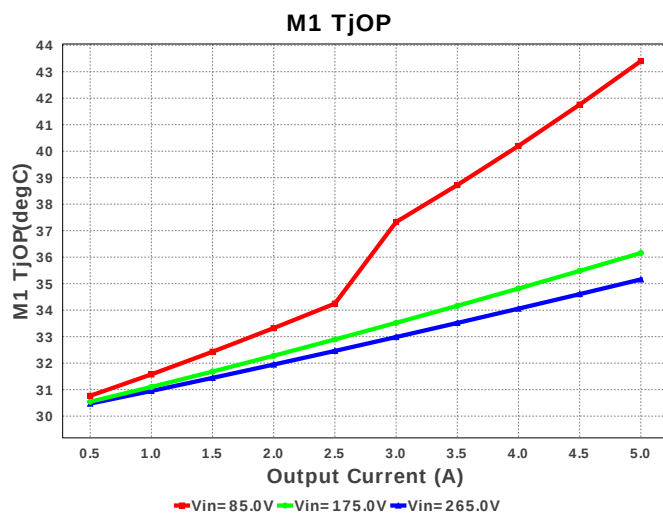
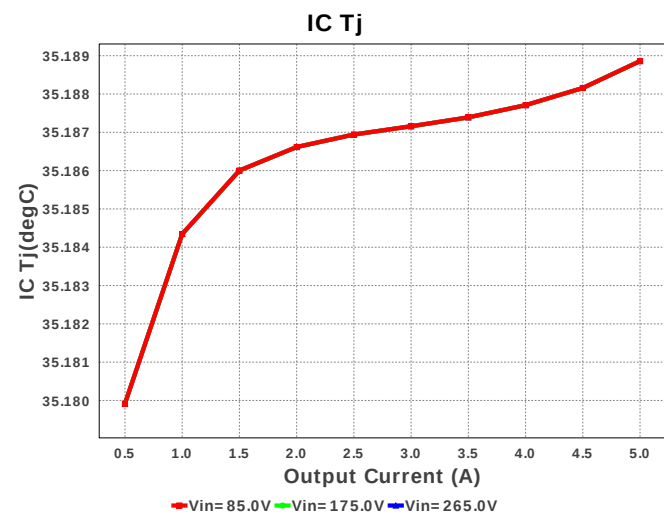
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
18.	Cy3	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm ²
19.	D21	Diodes Inc.	B230A-13-F	VF@Io= 500.0 mV VRRM= 30.0 V	1	\$0.09	 SMA 37 mm ²
20.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	\$0.24	 DF-S 99 mm ²
21.	Daux	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	\$0.21	 PowerDI123 13 mm ²
22.	Dsec	ON Semiconductor	MBRB40250TG	VF@Io= 860.0 mV VRRM= 250.0 V	1	\$0.94	 DDPAK 210 mm ²
23.	Dsec2	ON Semiconductor	MBRB40250TG	VF@Io= 860.0 mV VRRM= 250.0 V	1	\$0.94	 DDPAK 210 mm ²
24.	Dsnub	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 709.497 V	1	NA	CUSTOM 0 mm ²
25.	Dz	Diodes Inc.	DFLZ10-7	Zener	1	\$0.13	 PowerDI123 13 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	\$6.32	 CM6296 833 mm ²
27.	L2	Coilcraft	SER1590-152MLB	L= 1.5 µH DCR= 1.1 mOhm	1	\$1.12	 SER1590 324 mm ²
28.	M1	STMicroelectronics	STP57N65M5	VdsMax= 650.0 V IdsMax= 42.0 Amps	1	\$7.05	 TO-220AB 397 mm ²

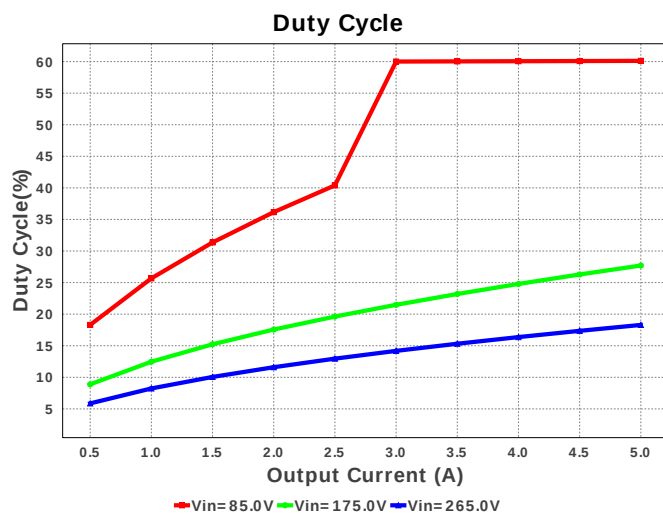
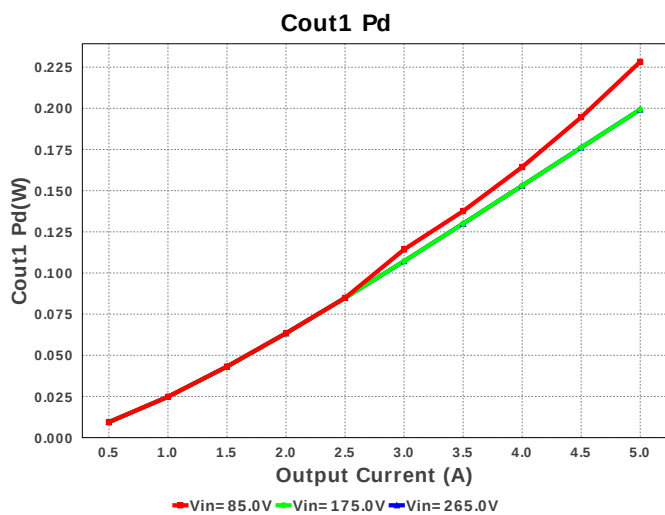
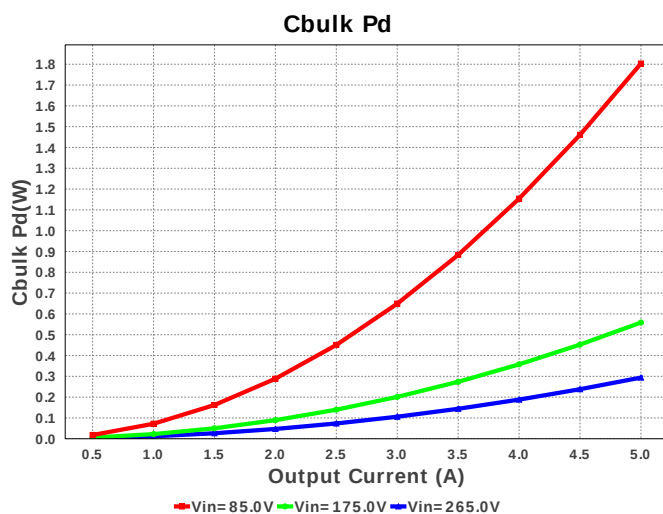
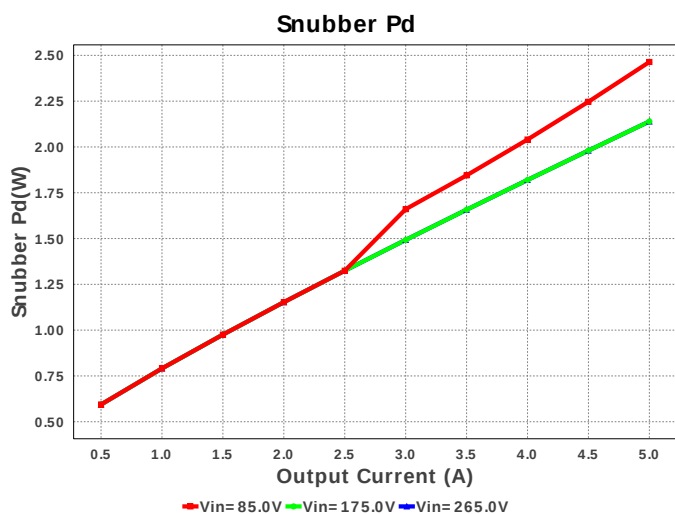
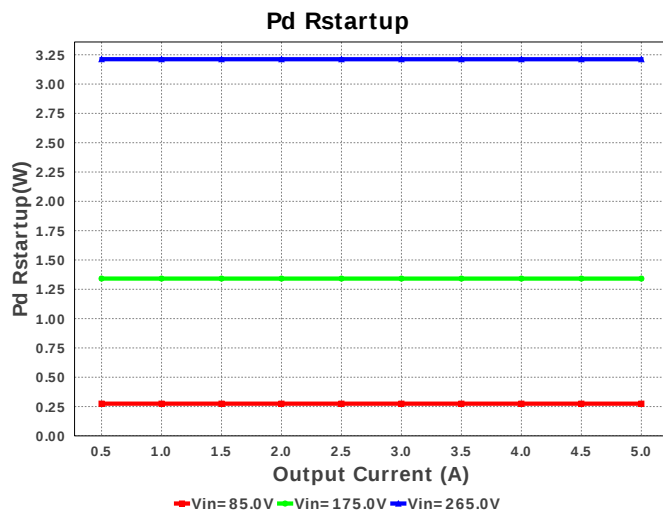
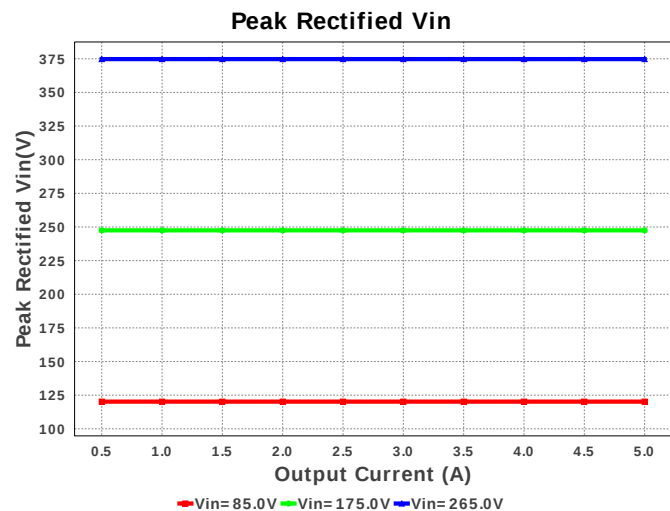
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
29.	O1	Vishay-Semiconductor	TCMT1107	Optocoupler	1	\$0.21	 SOP-4 44 mm ²
30.	Q1	ON Semiconductor	BC846BLT1G	Bipolar Transistor	1	\$0.02	 SOT-23 14 mm ²
31.	Qsc	STMicroelectronics	2N2222A	Bipolar Transistor	1	NA	 TO-18 57 mm ²
32.	R11	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
33.	R12	Vishay-Dale	CRCW04029K76FKED Series= CRCW..e3	Res= 9.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
34.	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
35.	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
36.	R22	Vishay-Dale	CRCW0402931KFKED Series= CRCW..e3	Res= 931.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
37.	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
38.	Rbias	Vishay-Dale	CRCW04025K62FKED Series= CRCW..e3	Res= 5.62 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
39.	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
40.	Rdrv	Vishay-Dale	CRCW08057R50FKEA Series= CRCW..e3	Res= 7.5 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
41.	Rfbb	Yageo America	RC0603FR-073K6L Series= ?	Res= 3.6 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
42.	Rfbt	Vishay-Dale	CRCW040213K7FKED Series= CRCW..e3	Res= 13.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
43.	Rled	Vishay-Dale	CRCW04026K98FKED Series= CRCW..e3	Res= 6.98 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
44.	Rsc	Vishay-Dale	CRCW04029K53FKED Series= CRCW..e3	Res= 9.53 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
45.	Rsns	Stackpole Electronics Inc	CSRN2512FKR330 Series= ?	Res= 330.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	\$0.13	 2512 43 mm ²
46.	Rsub1	Vishay-Bcomponents	PR03000202002JAC00 Series= ?	Res= 20.0 kOhm Power= 3.0 W Tolerance= 5.0%	1	\$0.19	 PR03 0 mm ²
47.	Rsub2	Vishay-Bcomponents	PR03000202002JAC00 Series= ?	Res= 20.0 kOhm Power= 3.0 W Tolerance= 5.0%	1	\$0.19	 PR03 0 mm ²
48.	Rstartup1	Vishay-Dale	CRCW120680K6FKEA Series= CRCW..e3	Res= 80.6 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²

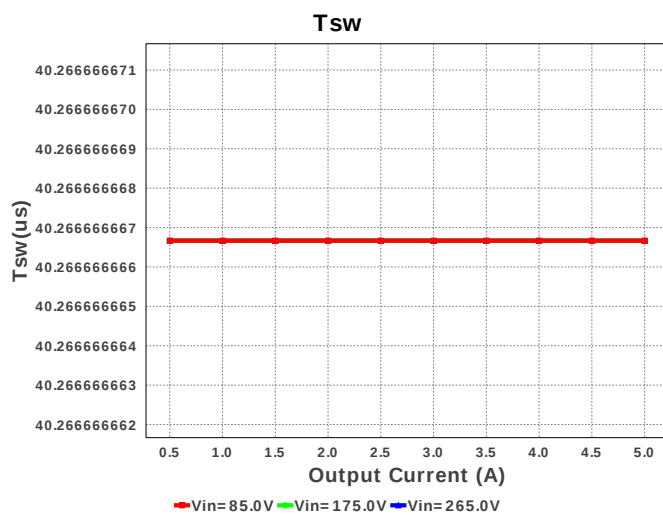
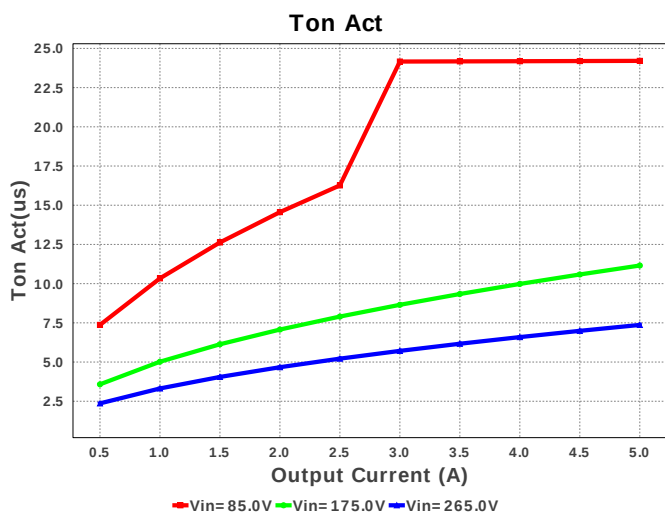
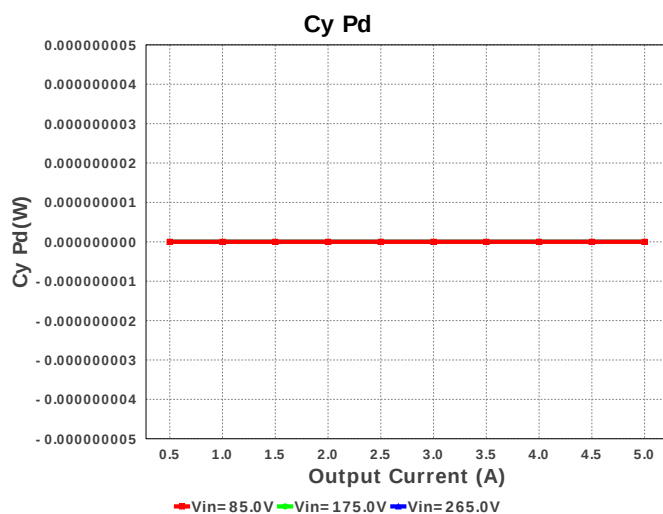
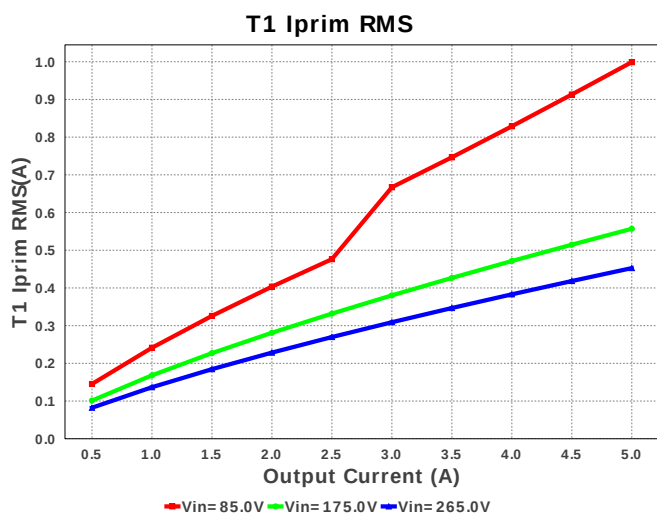
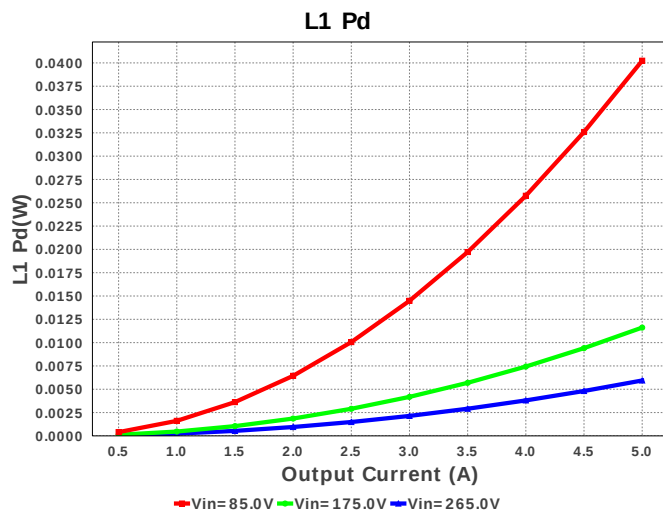
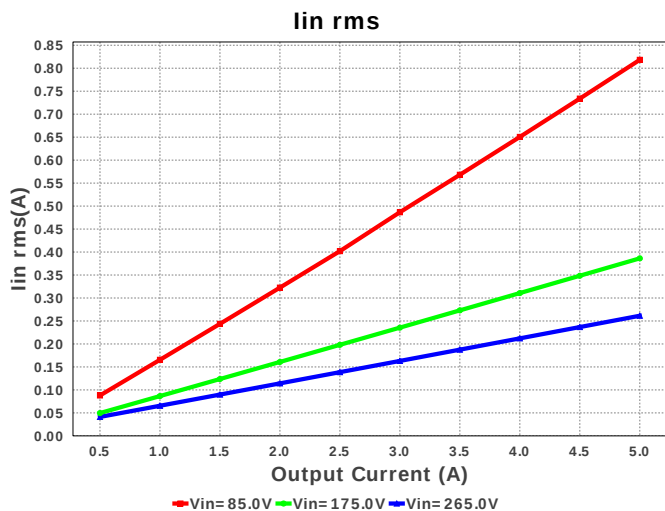
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
49.	Rstartup2	Vishay-Dale	CRCW120680K6FKEA Series= CRCW..e3	Res= 80.6 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
50.	Rt	Panasonic	ERJ-6ENF6042V Series= ERJ-6E	Res= 60.4 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 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	Vishay-Dale	CRCW04021K10FKED Series= CRCW..e3	Res= 1.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
54.	T1	CUSTOM	CUSTOM	Lp= 1.506 mH Rp= 870.0 mOhm Leakage_L= 30.125 μH Ns1toNp= 0.1 Rs1= 8.6 mOhms Ns2toNp= 0.116 Rs2= 700.0 μOhms	1	NA	CUSTOM 0 mm ²
55.	U1	Texas Instruments	UCC2802DTR	Switcher	1	\$1.20	 D0008A 57 mm ²
56.	VR	Texas Instruments	TL431AIDBZR	Voltage References	1	\$0.08	 DBZ0003A 14 mm ²

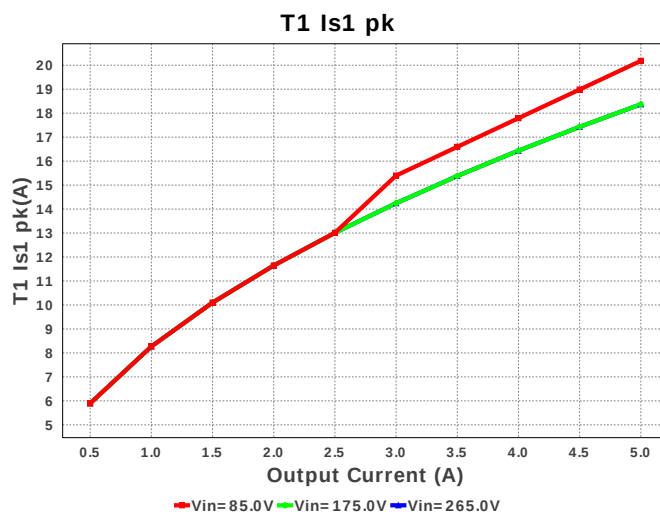
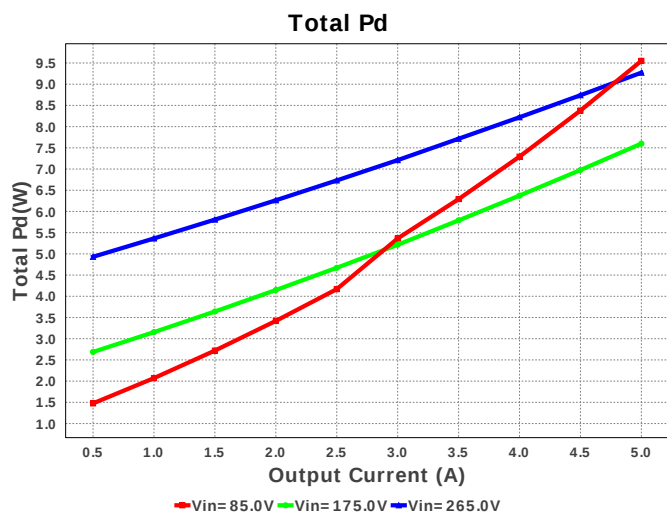
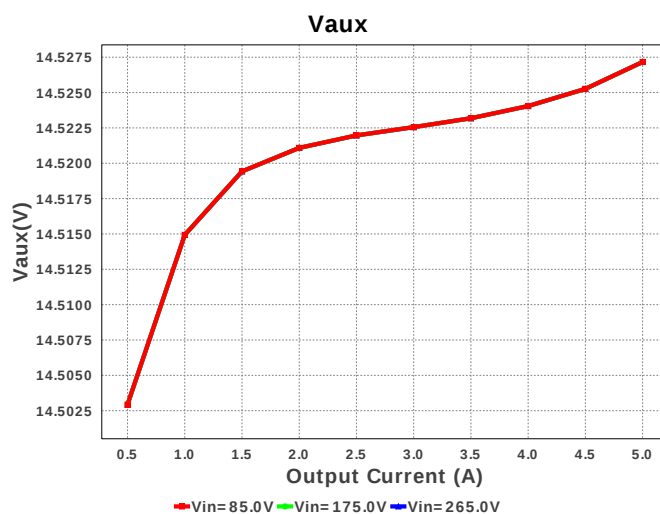
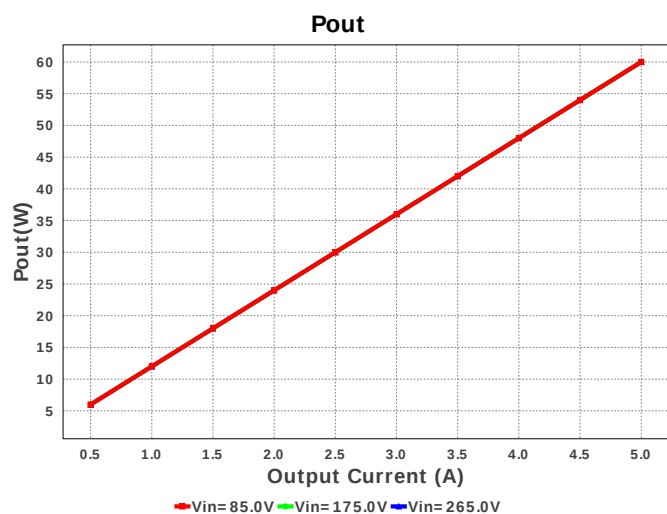
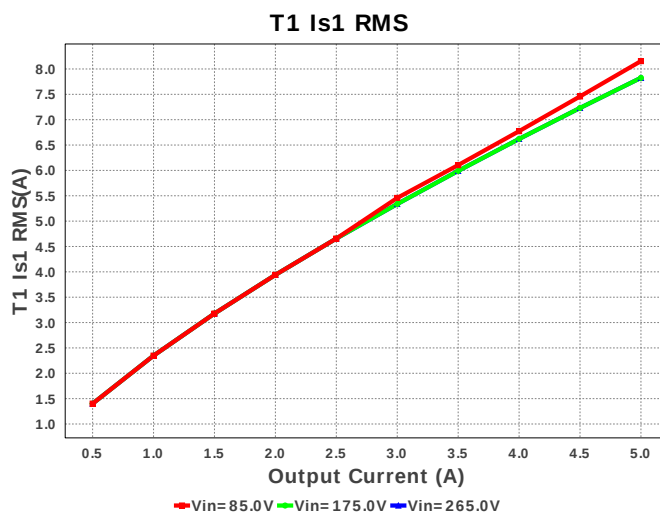
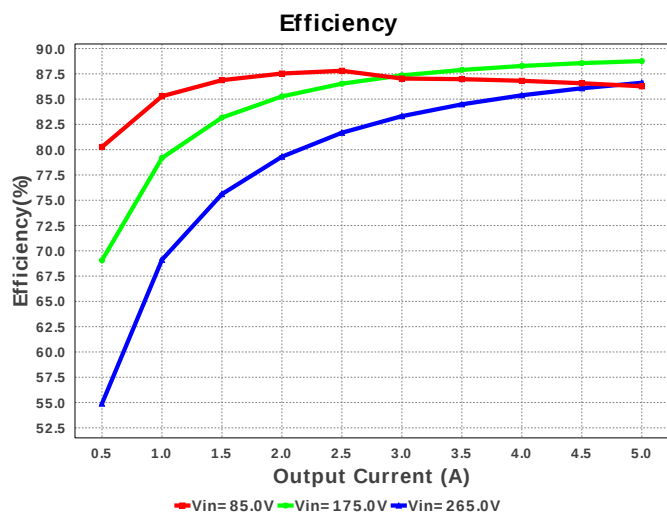


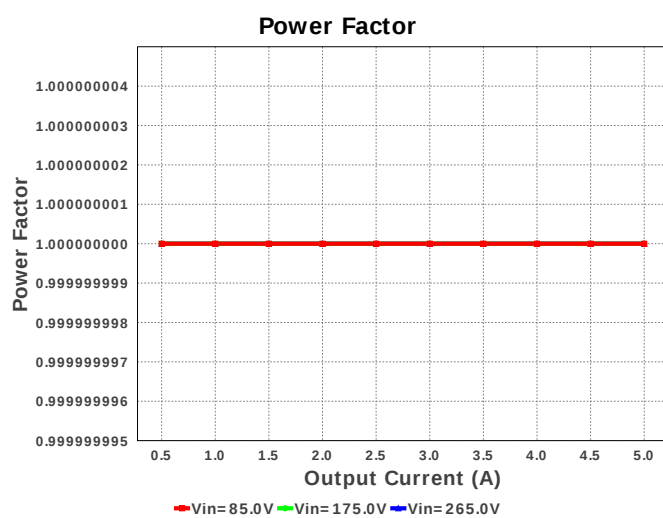
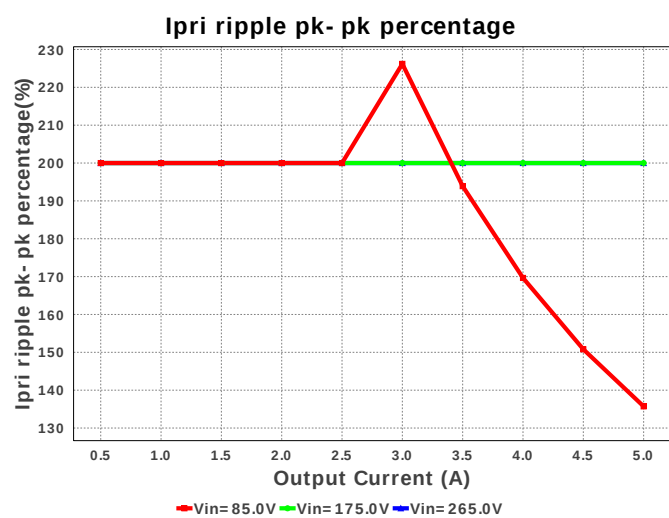
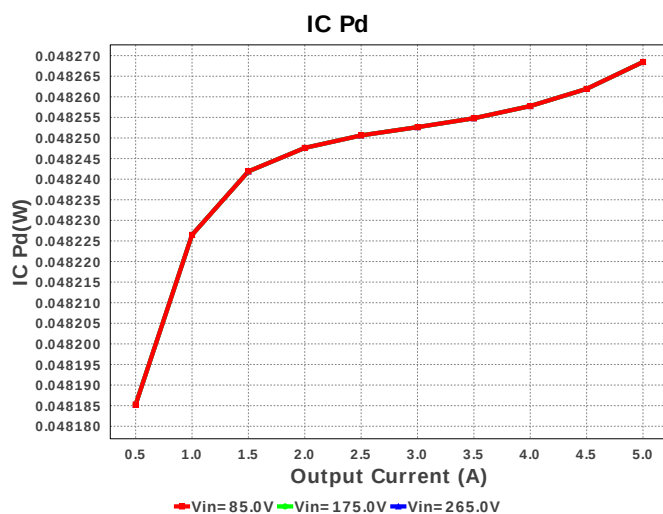
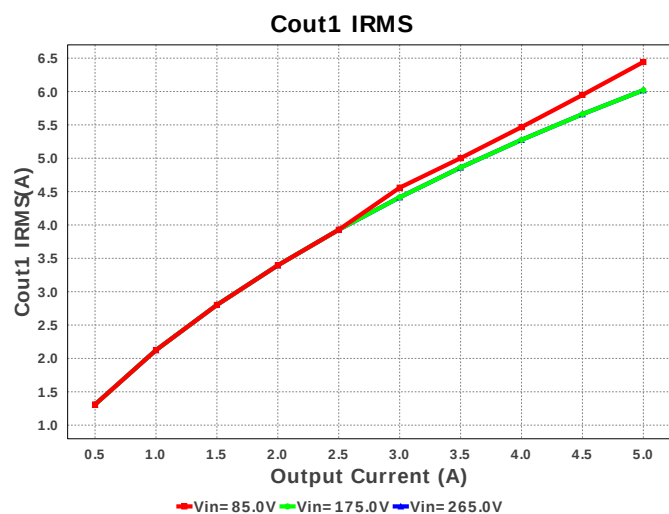
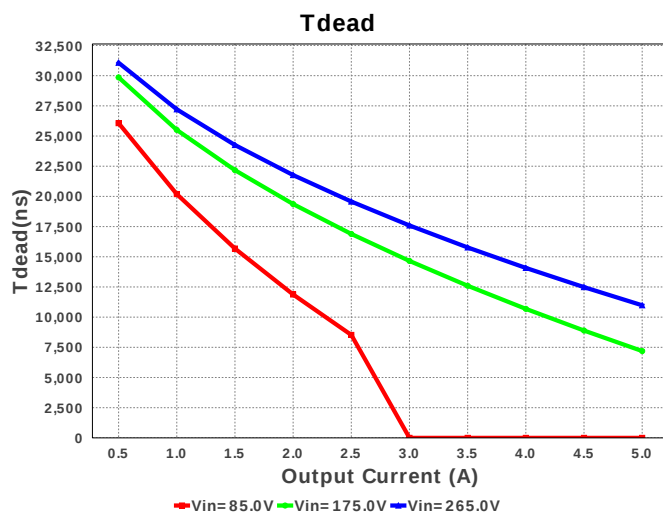
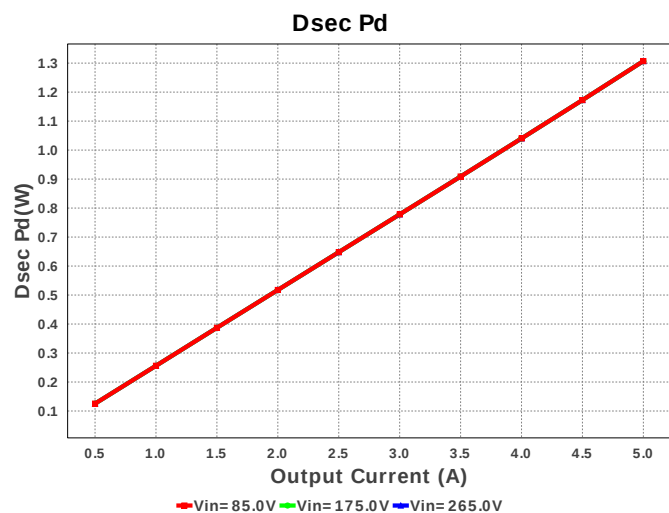


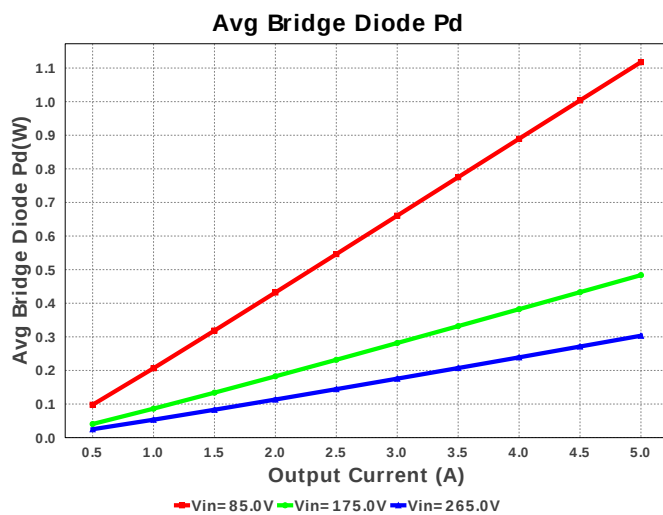
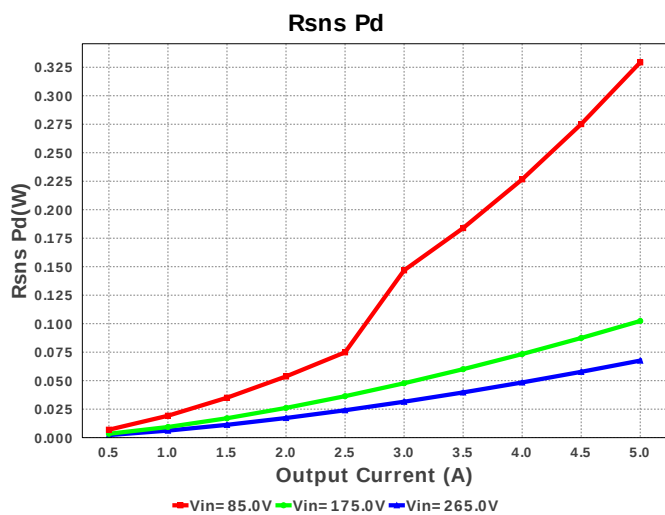
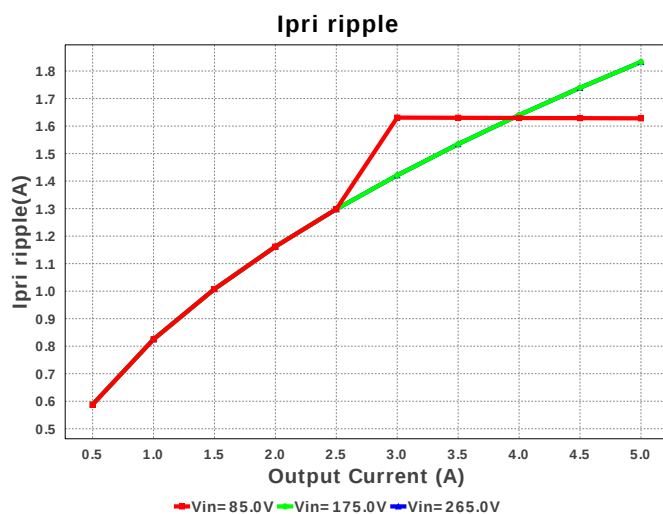
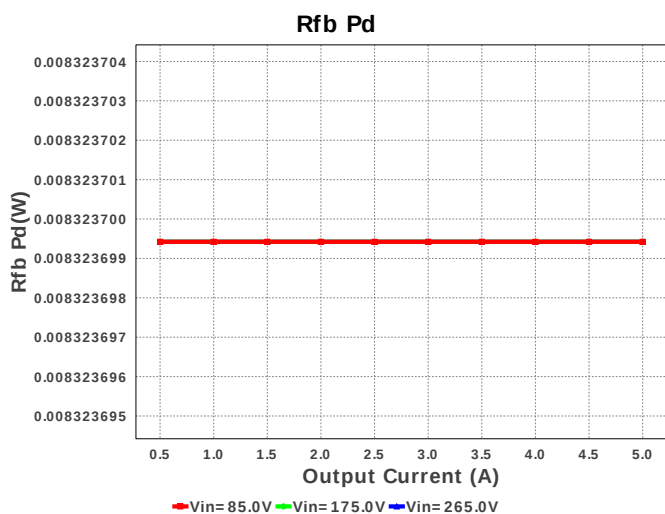
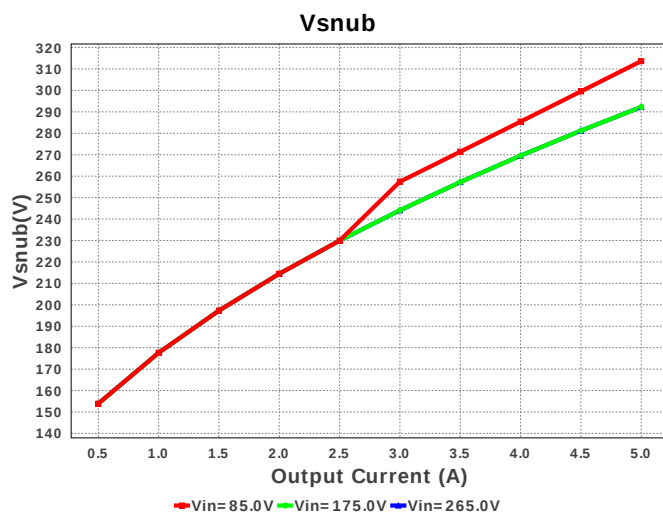
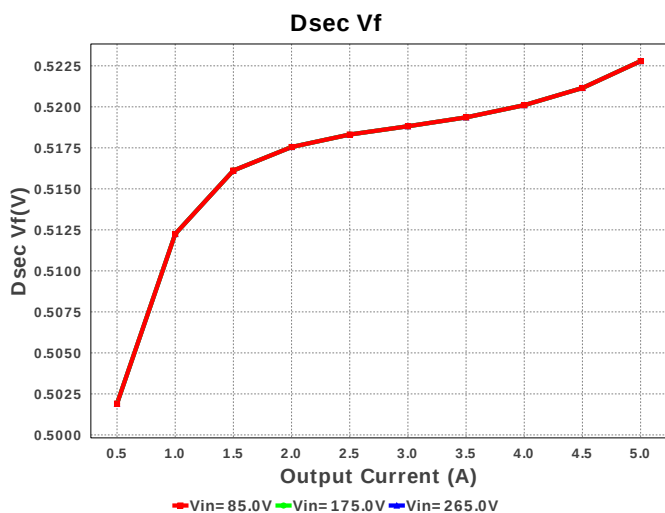


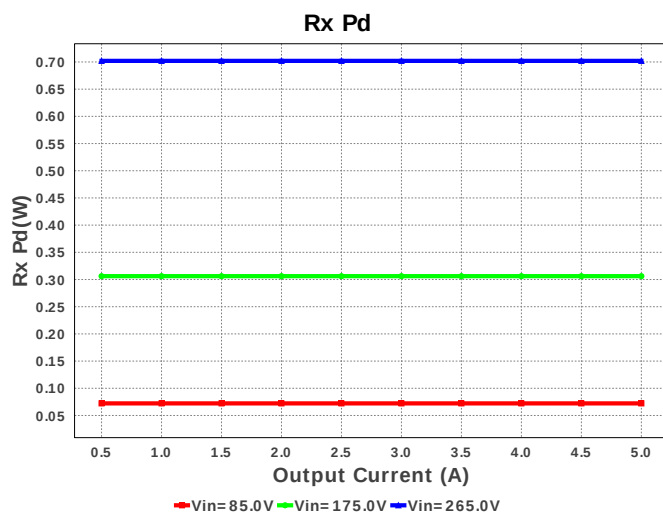
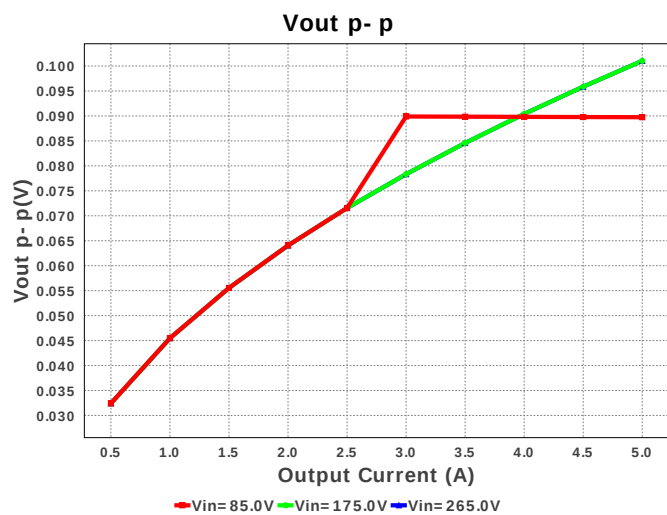
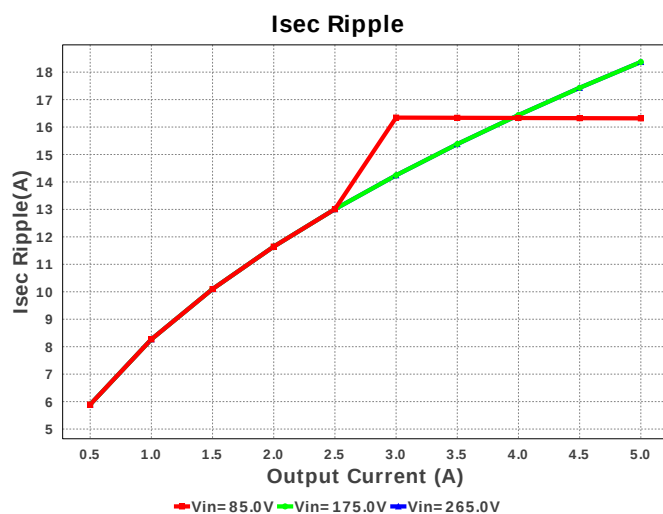
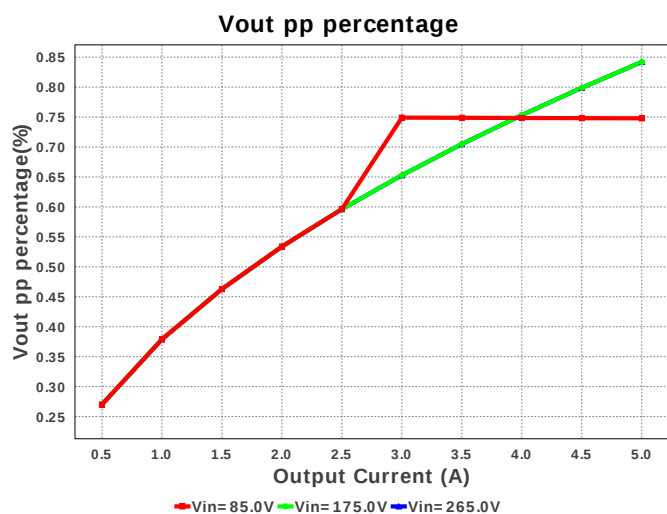
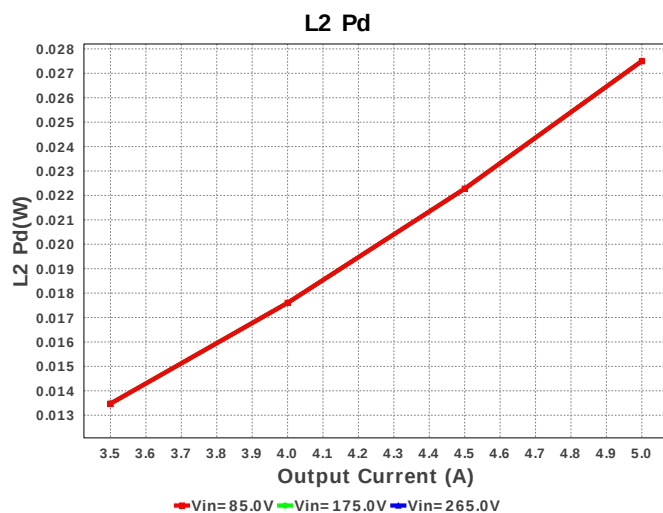
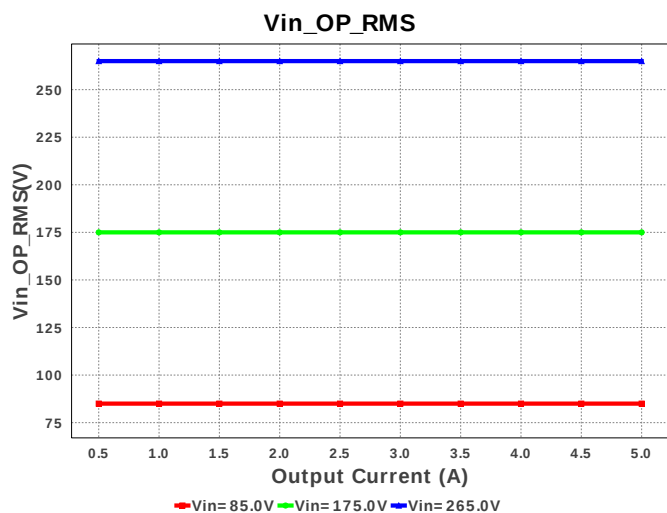


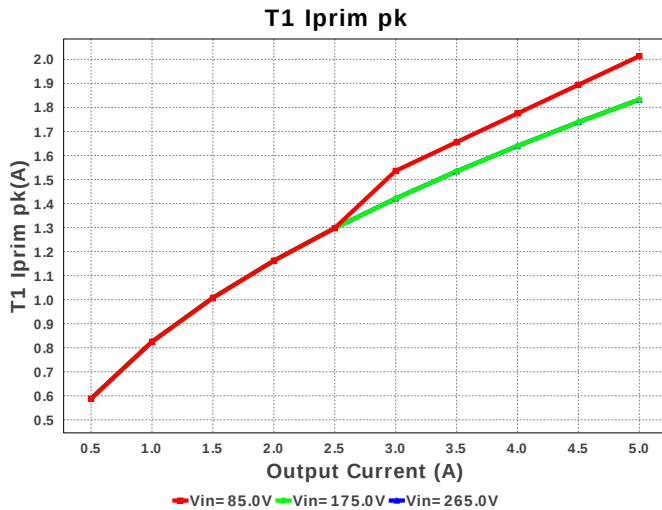












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	6.443 A	Current	Output capacitor1 RMS ripple current
2.	Iin rms	818.24 mA	Current	RMS Input Current
3.	Iout_DCM	2.85 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	721.114 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	1.628 A	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	135.717 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	16.317 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	998.913 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	2.014 A	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	8.155 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	20.181 A	Current	Transformer Secondary1 Peak Current
12.	AC Frequency	60.0 Hz	General	Input AC frequency
13.	BOM Count	66	General	Total Design BOM count
14.	Daux trr	0.0 ns	General	Auxiliary Diode Reverse Recovery Time
15.	Dsec Vf	522.788 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	522.788 mV	General	Effective Forward Voltage Drop at the Operating Current
18.	Dsnub trr	0.0 ns	General	Snubber Diode Reverse Recovery Time
19.	FootPrint	7.653 k mm ²	General	Total Foot Print Area of BOM components
20.	Frequency	24.834 kHz	General	Switching frequency
21.	Mode	CCM	General	Conduction Mode
22.	Pout	60.0 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	16.746 us	General	Approximate Converter Off Time
26.	Ton Act	24.205 us	General	Approximate Converter On Time
27.	Total BOM	\$0.0	General	Total BOM Cost
28.	Tsw	40.267 us	General	Switching Time Period
29.	Vaux	14.527 V	General	Auxiliary Voltage
30.	Vsnub	313.681 V	General	Voltage Across the Snubber
31.	Vout Actual	11.99 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
32.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
33.	Duty Cycle	60.113 %	Op_point	Duty cycle
34.	Efficiency	86.269 %	Op_point	Steady state efficiency
35.	IC Tj	35.189 degC	Op_point	IC junction temperature
36.	ICThetaJA	107.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
37.	IOUT_OP	5.0 A	Op_point	Iout operating point
38.	M1 TjOP	43.4 degC	Op_point	M1 MOSFET junction temperature
39.	Peak Rectified Vin	120.207 V	Op_point	Peak voltage seen at rectified input
40.	Vin_OP_RMS	85.0 V	Op_point	AC Input RMS Voltage
41.	Vout p-p	89.744 mV	Op_point	Peak-to-peak output ripple voltage
42.	Avg Bridge Diode Pd	1.118 W	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
43.	Cbulk Pd	1.803 W	Power	Bulk capacitor power dissipation
44.	Cout1 Pd	228.287 mW	Power	Output capacitor1 power dissipation
45.	Cx Pd	0.0 W	Power	X-cap Power Dissipation
46.	Cy Pd	0.0 W	Power	Y-caps Power Dissipation
47.	Dsec Pd	1.307 W	Power	Secondary Diode Power Dissipation
48.	Dsec2 Pd	1.307 W	Power	Secondary Diode Power Dissipation
49.	IC Pd	48.268 mW	Power	IC power dissipation
50.	L1 Pd	40.235 mW	Power	Power Dissipation in the Inductor

#	Name	Value	Category	Description
51.	L2 Pd	27.5 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
52.	M1 Pd	214.404 mW	Power	M1 MOSFET total power dissipation
53.	Paux	14.442 mW	Power	Power Dissipation in Raux and Daux
54.	Pd Rstartup	274.667 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
55.	Rdrv Pd	44.424 μ W	Power	Power Dissipation in Gate Drive Resistor
56.	Rfb Pd	8.324 mW	Power	Rfb Power Dissipation
57.	Rsns Pd	329.283 mW	Power	Current Limit Sense Resistor Power Dissipation
58.	Rx Pd	72.227 mW	Power	Total Power Dissipation in Rx1 and Rx2
59.	Snubber Pd	2.464 W	Power	Snubber Power Dissipation
60.	T1 Pd	2.88 W	Power	Estimated Losses in Transformer
61.	Total Pd	9.55 W	Power	Total Power Dissipation
62.	Vout Tolerance	1.926 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
63.	Vout pp percentage	747.868 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	VinMax	265.0	Maximum input voltage
3.	VinMin	85.0	Minimum input voltage
4.	Vout	12.0	Output Voltage
5.	acFrequency	0.0	Light Output in Lumen
6.	base_pn	UCC2802	Texas Instruments Base Part Number
7.	source	AC	Input Source Type
8.	ta	30.0	Ambient temperature
9.	userfs	47.468 k	Customer Selected Frequency

Design Assistance

1. UCC2802 Product Folder : <http://www.ti.com/product/UCC2802> : contains the data sheet and other resources.

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