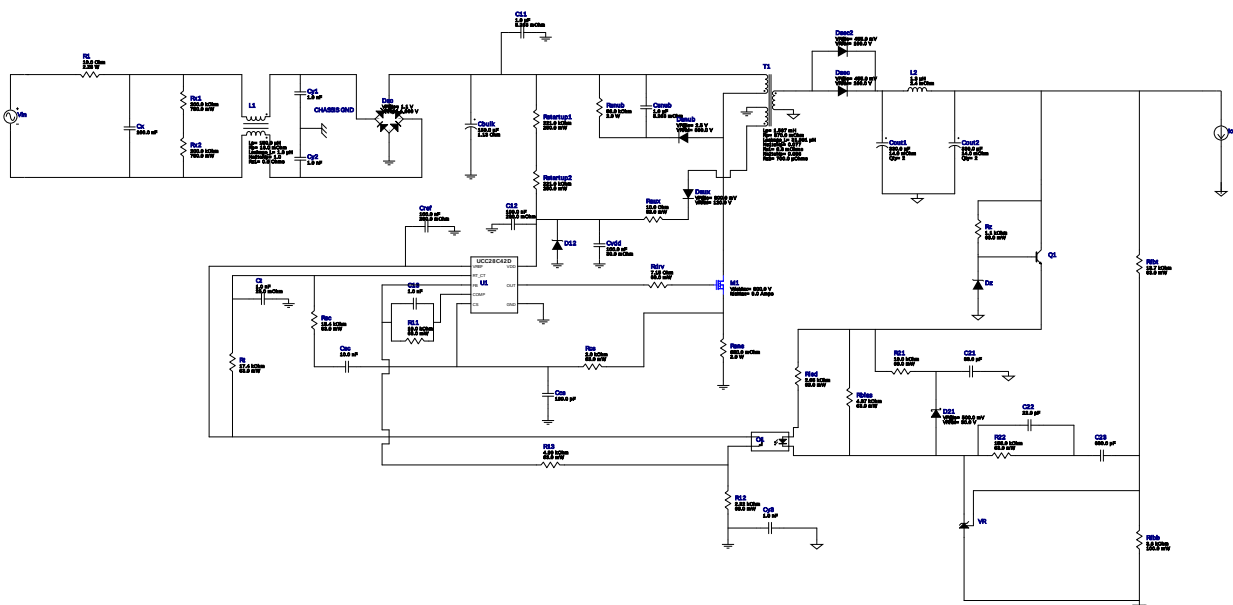


WEBENCH® Design Report

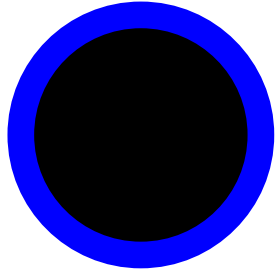
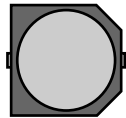
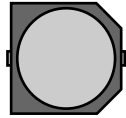
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UCC28C42DR 110.0V-250.0V to 12.00V @ 5.0A

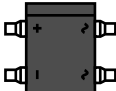


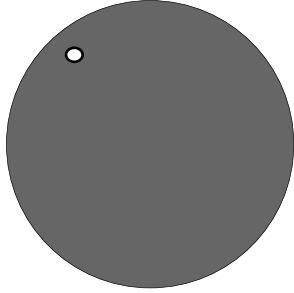
1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.

Electrical BOM

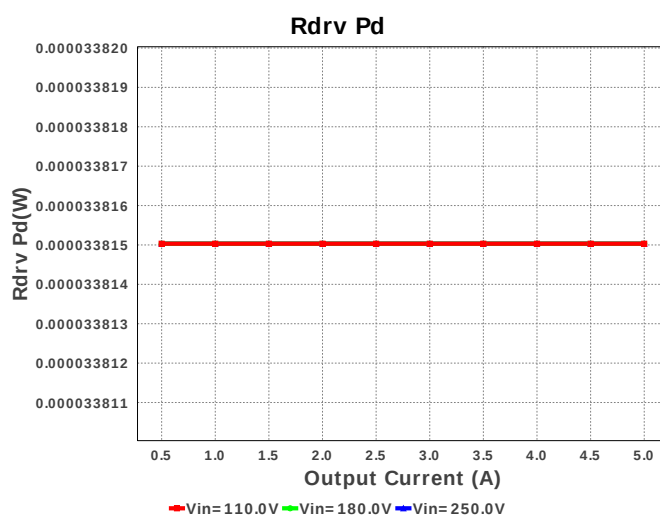
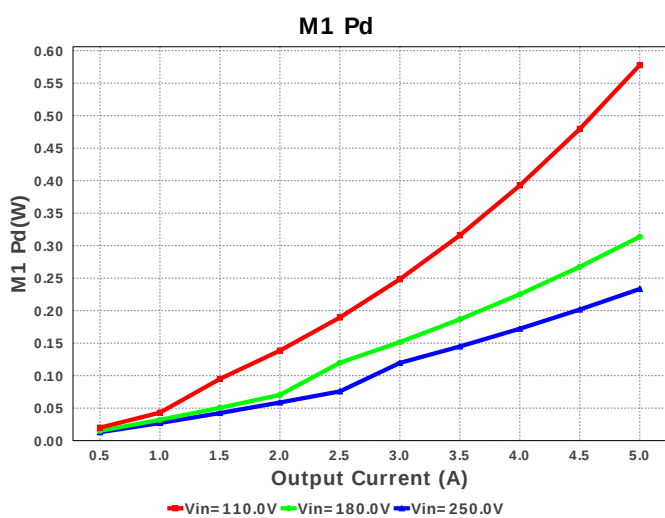
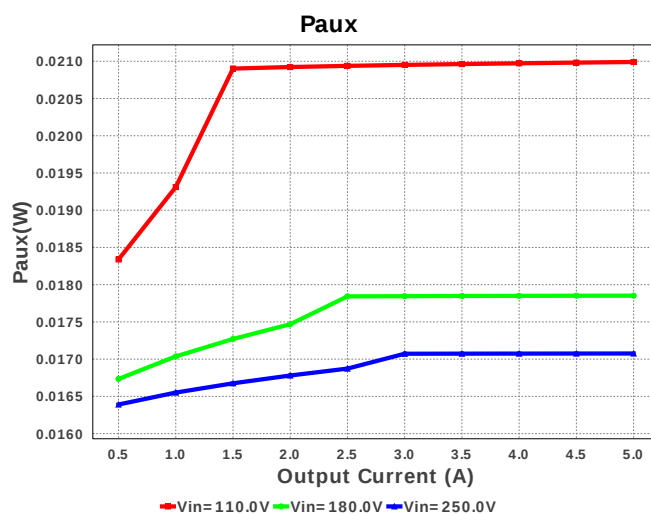
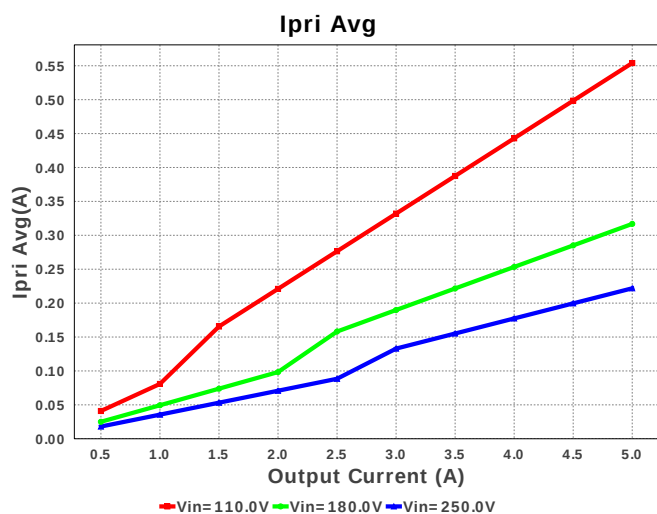
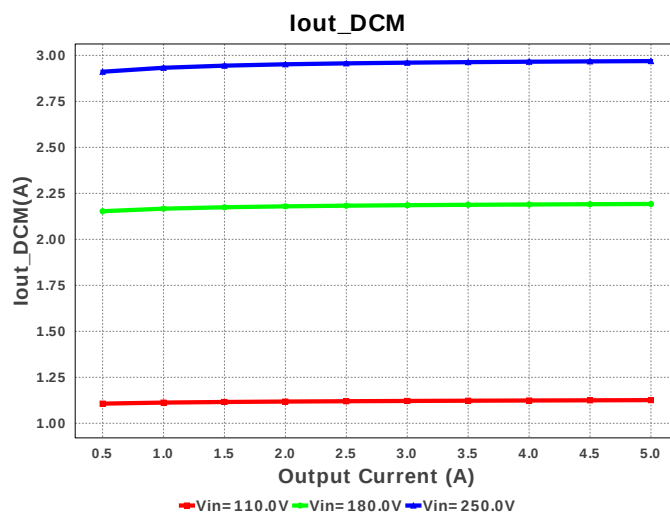
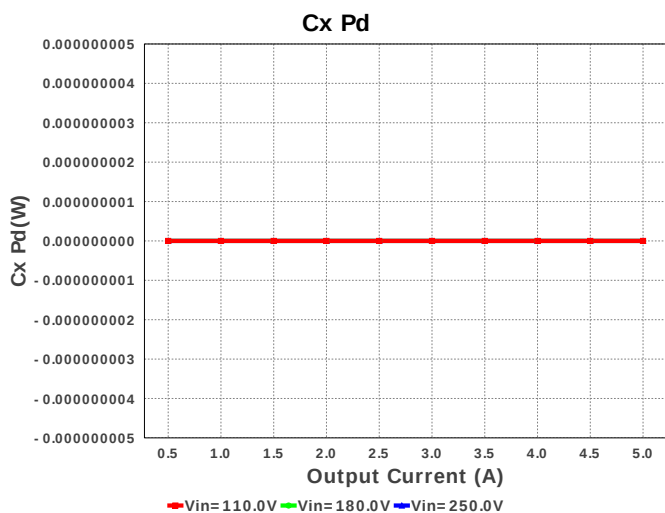
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C11	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	\$1.19	 2220 54 mm ²
2.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
3.	C13	Samsung 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	KCM55WR7YA336MH01K Series= X7R	Cap= 33.0 uF VDC= 35.0 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

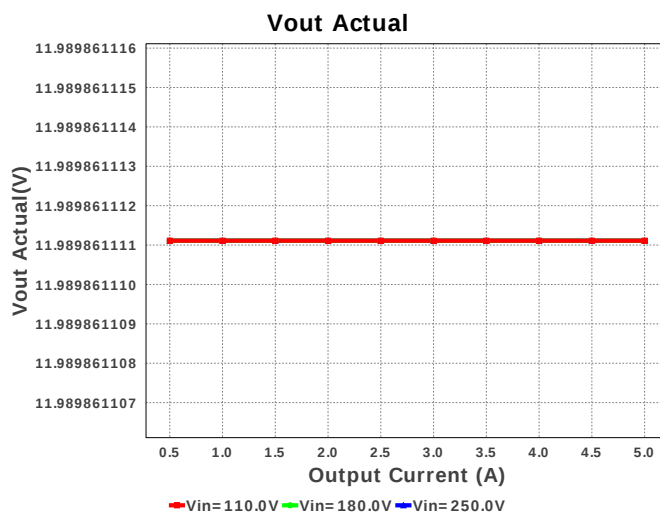
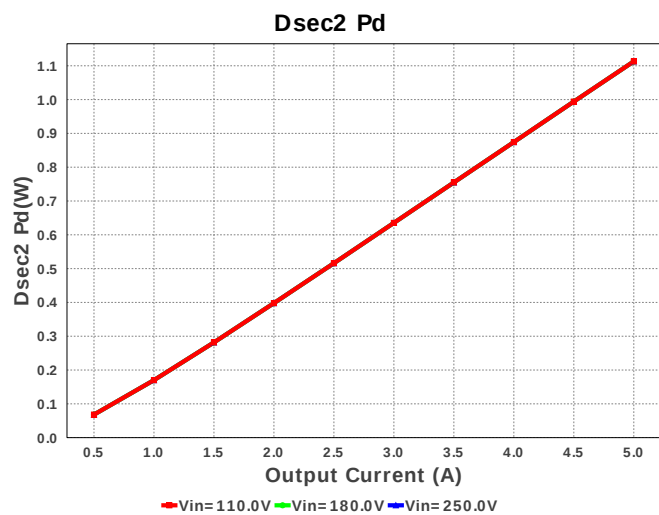
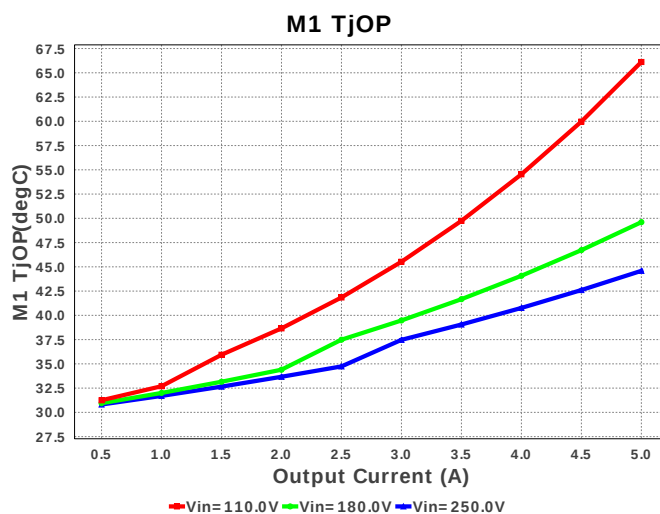
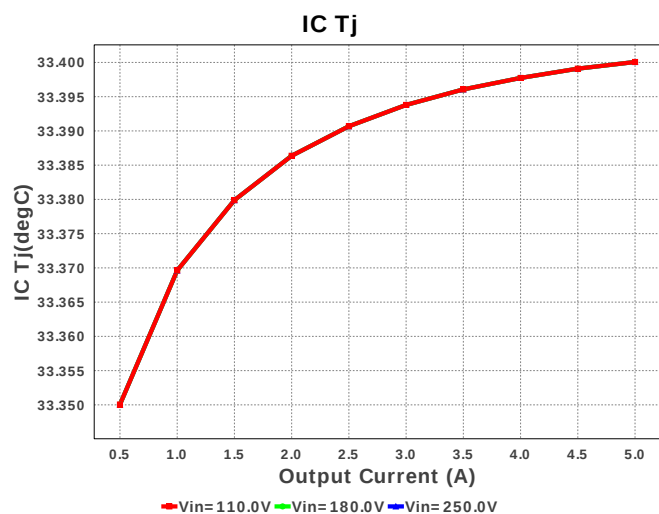
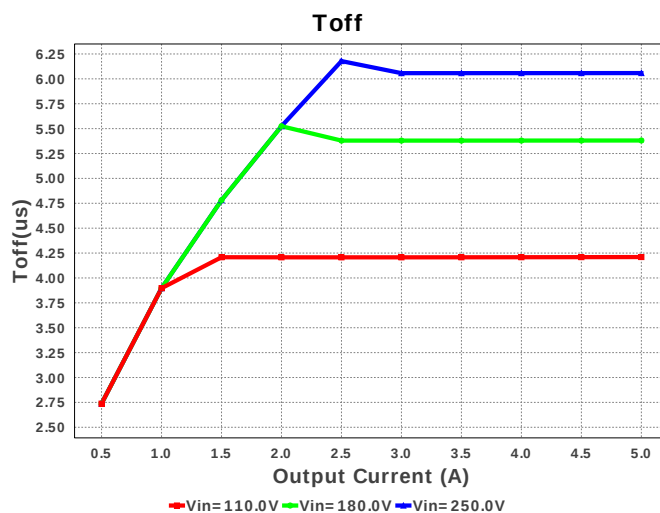
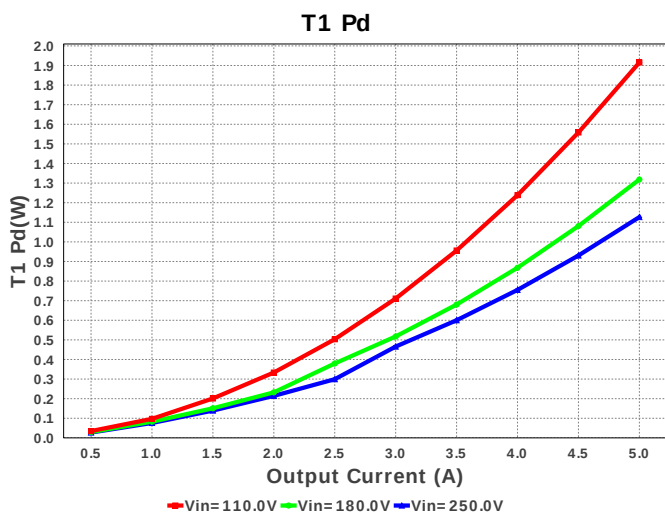
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cbulk	Vishay-Bccomponents	MAL215759151E3 Series= 2239	Cap= 150.0 uF ESR= 1.13 Ohm VDC= 500.0 V IRMS= 1.43 A	1	\$4.45	 157PUM-SI_2500x4000 729 mm ²
8.	Ccs	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
9.	Cout1	Panasonic	25SVPF330M Series= ?	Cap= 330.0 uF ESR= 14.0 mOhm VDC= 25.0 V IRMS= 5.0 A	2	\$0.70	 CAPSMT_62_F12 151 mm ²
10.	Cout2	Panasonic	25SVPF330M Series= ?	Cap= 330.0 uF ESR= 14.0 mOhm VDC= 25.0 V IRMS= 5.0 A	2	\$0.70	 CAPSMT_62_F12 151 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.	Cvdd	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

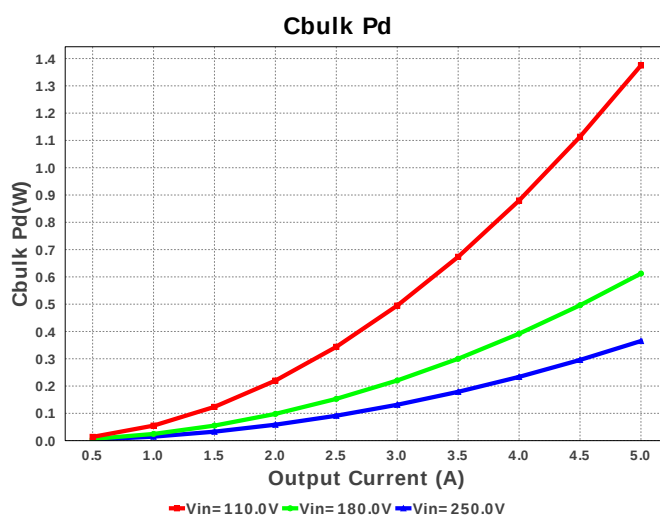
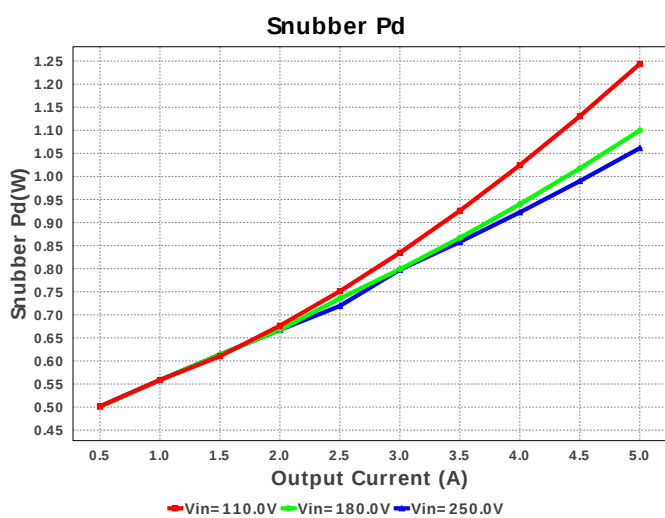
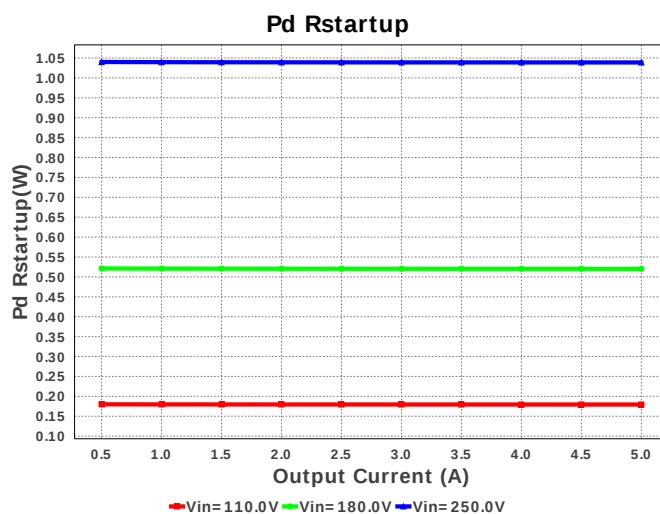
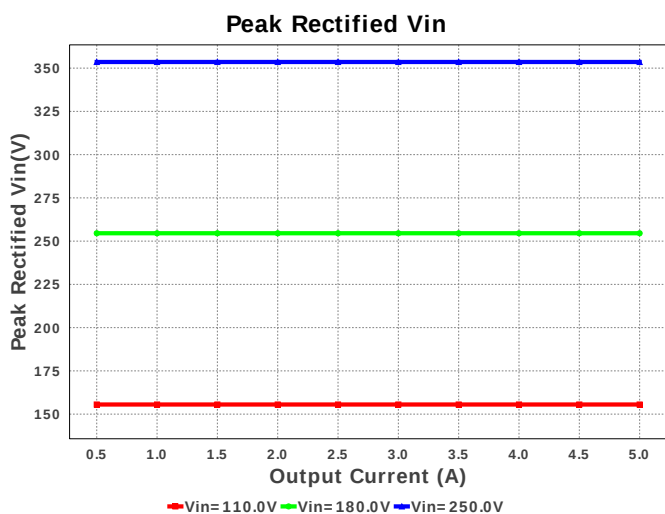
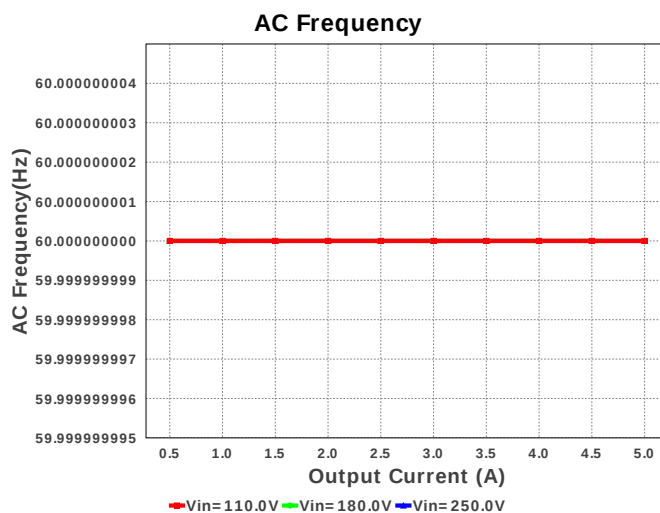
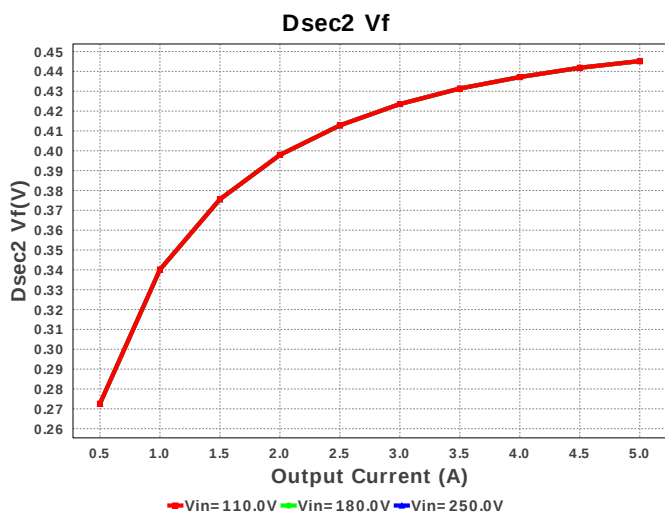
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
18.	Cy2	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm ²
19.	Cy3	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm ²
20.	D12	Diodes Inc.	MMSZ5248B-7-F	Zener	1	\$0.04	 SOD-123 13 mm ²
21.	D21	Diodes Inc.	B230A-13-F	VF@Io= 500.0 mV VRRM= 30.0 V	1	\$0.09	 SMA 37 mm ²
22.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	\$0.24	 DF-S 99 mm ²
23.	Daux	Fairchild Semiconductor	FSV10120V	VF@Io= 800.0 mV VRRM= 120.0 V	1	\$0.21	 TO-277A 56 mm ²
24.	Dsec	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	\$1.33	 DDPAK 210 mm ²
25.	Dsec2	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	\$1.33	 DDPAK 210 mm ²
26.	Dsnub	Bourns	CD1408-FU1800	VF@Io= 2.5 V VRRM= 800.0 V	1	\$0.13	 Diode_1408 13 mm ²
27.	Dz	ON Semiconductor	BZX84C9V1LT1G	Zener	1	\$0.02	 SOT-23 14 mm ²

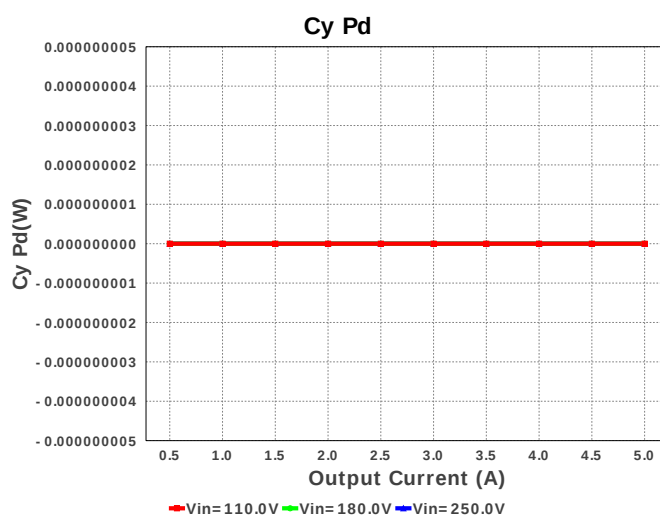
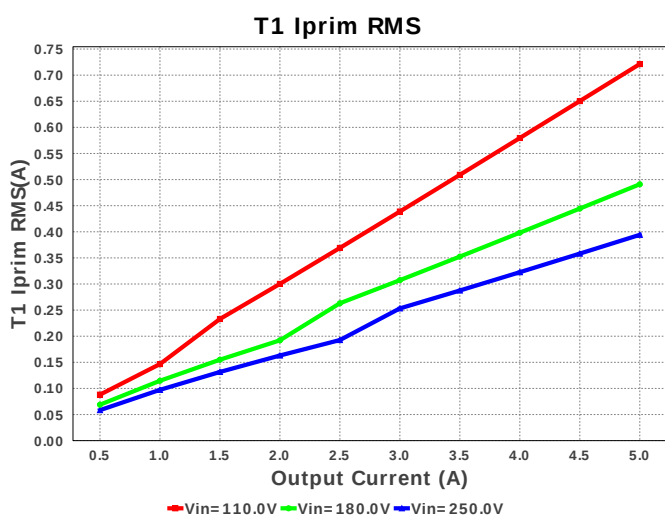
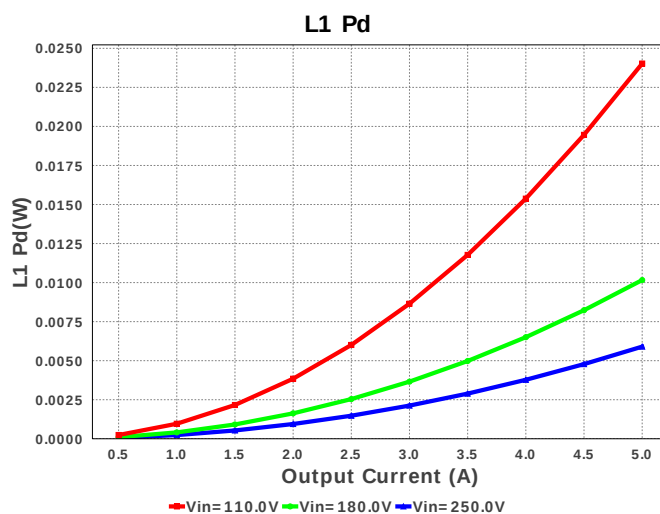
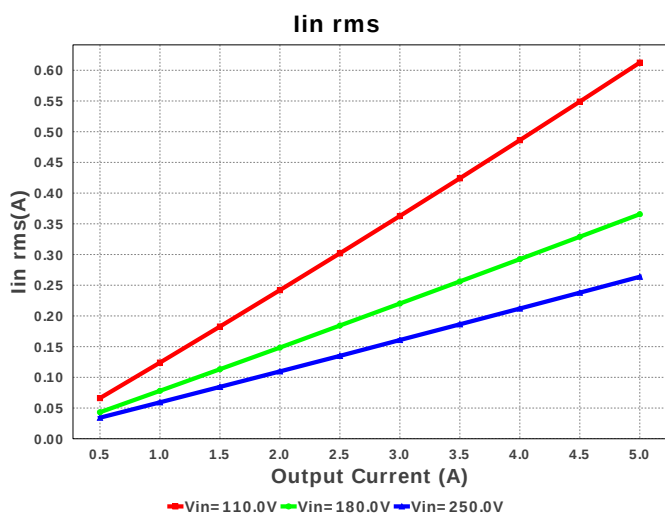
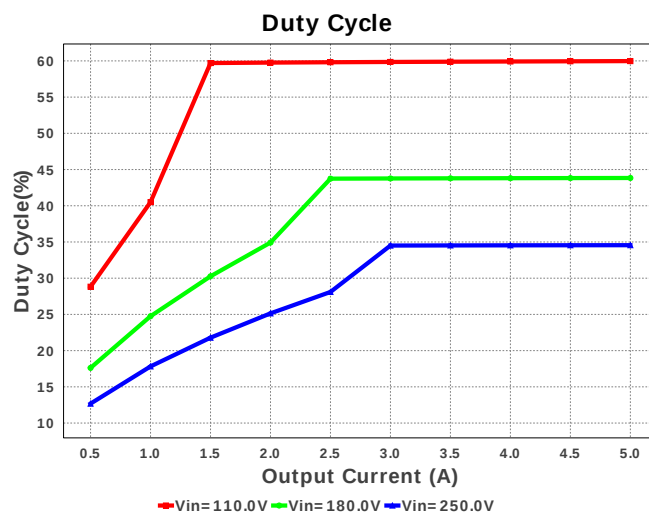
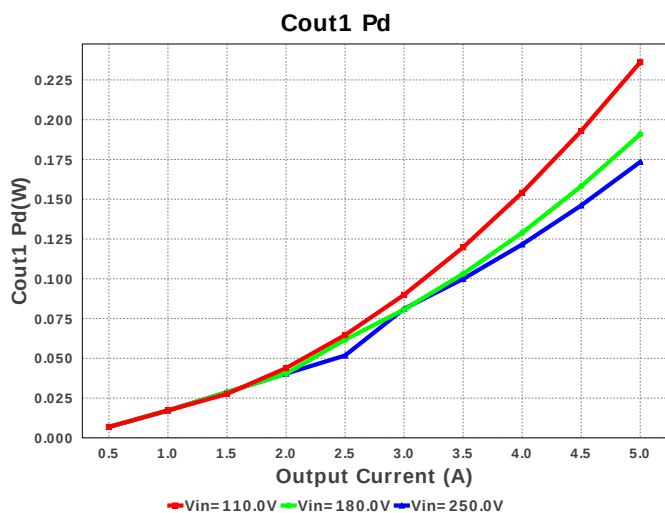
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28. L1		API Delevan	CM6296R-154	Lp= 150.0 μ H Rp= 16.0 mOhm Leakage_L= 1.8 μ H Ns1toNp= 1.0 Rs1= 0.0 Ohms	1	\$5.95	 CM6296 833 mm ²
29. L2		Coilcraft	MLC1250-132MLB	L= 1.3 μ H DCR= 2.4 mOhm	1	\$0.79	 MLC1250 165 mm ²
30. M1		STMicroelectronics	STF10N80K5	VdsMax= 800.0 V IdsMax= 9.0 Amps	1	\$2.52	 TO-220FP 79 mm ²
31. O1		Vishay-Semiconductor	TCMT1107	Optocoupler	1	\$0.21	 SOP-4 44 mm ²
32. Q1		ON Semiconductor	BC846BLT1G	Bipolar Transistor	1	\$0.02	 SOT-23 14 mm ²
33. 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
34. 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
35. R12		Vishay-Dale	CRCW04022K32FKED Series= CRCW..e3	Res= 2.32 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
36. 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
37. 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
38. R22		Vishay-Dale	CRCW0402158KFKED Series= CRCW..e3	Res= 158.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
39. 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
40. Rbias		Vishay-Dale	CRCW04024K87FKED Series= CRCW..e3	Res= 4.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
41. 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
42. Rdrv		Vishay-Dale	CRCW04027R15FKED Series= CRCW..e3	Res= 7.15 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
43. Rfbb		Yageo America	RC0603FR-073K6L Series= ?	Res= 3.6 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
44. 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

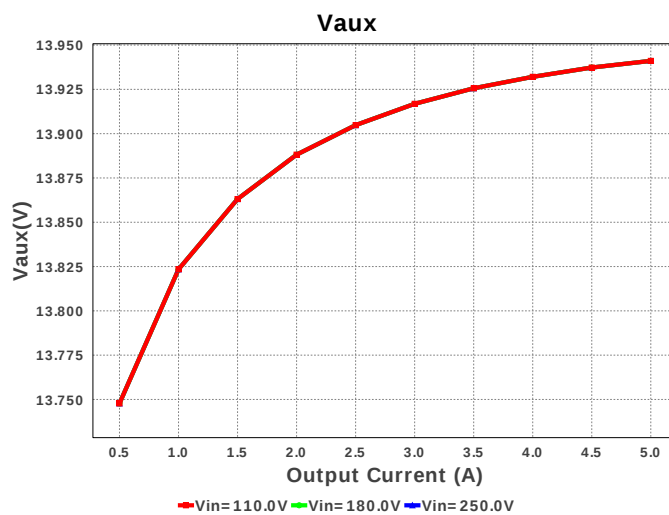
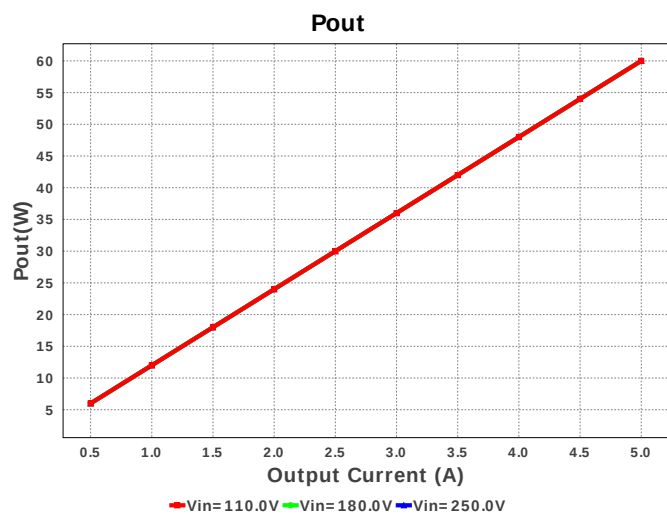
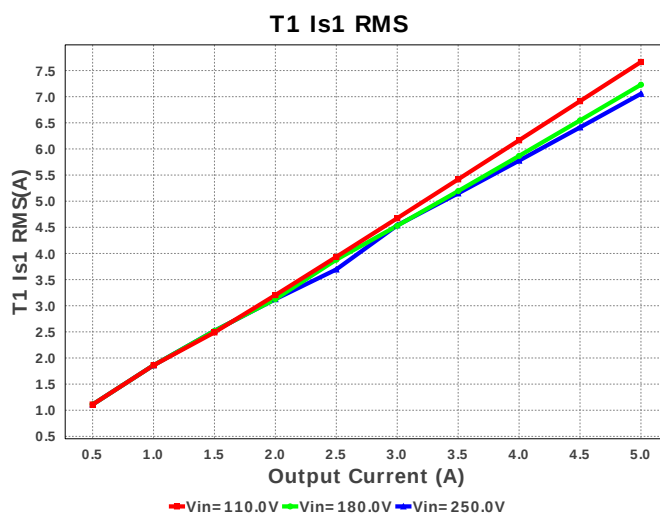
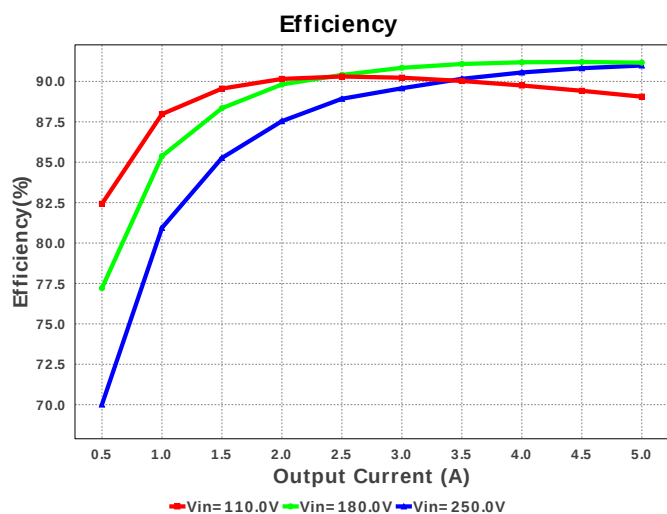
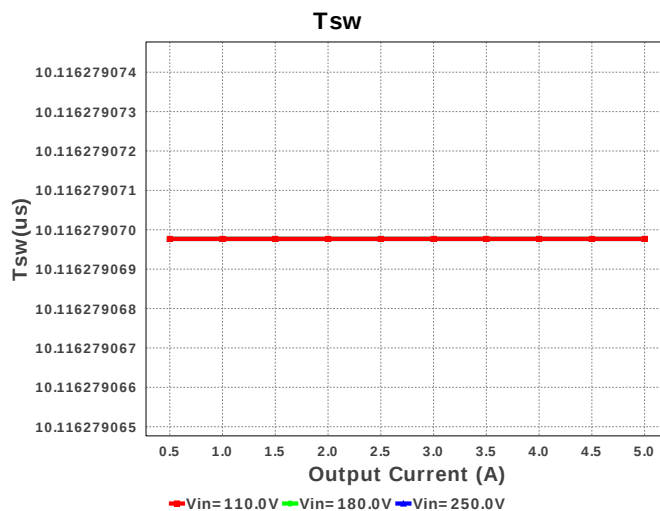
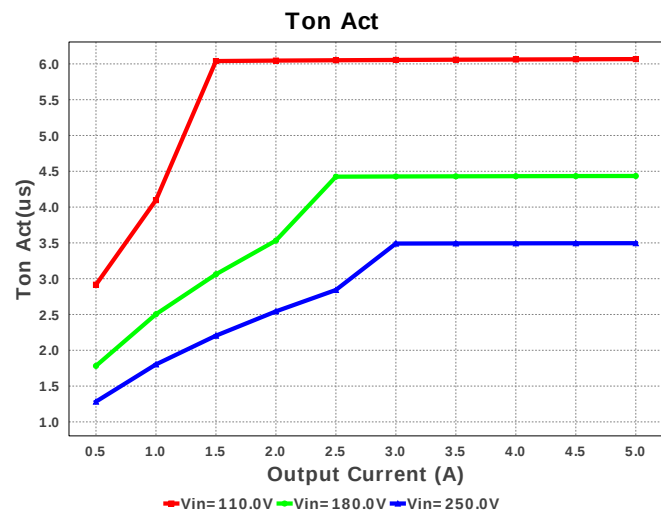
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
45.	Rled	Vishay-Dale	CRCW04022K05FKED Series= CRCW..e3	Res= 2.05 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
46.	Rsc	Vishay-Dale	CRCW040215K4FKED Series= CRCW..e3	Res= 15.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
47.	Rsns	Stackpole Electronics Inc	CSRN2512FKR680 Series= ?	Res= 680.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	\$0.09	 2512 43 mm ²
48.	Rsnub	Vishay-Bcomponents	PR02000205602JR500 Series= ?	Res= 56.0 kOhm Power= 2.0 W Tolerance= 5.0%	1	\$0.05	PR02 113 mm ²
49.	Rstartup1	Panasonic	ERJ-8ENF2213V Series= ERJ-8E	Res= 221.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
50.	Rstartup2	Panasonic	ERJ-8ENF2213V Series= ERJ-8E	Res= 221.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
51.	Rt	Vishay-Dale	CRCW040217K4FKED Series= CRCW..e3	Res= 17.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
52.	Rx1	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm ²
53.	Rx2	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm ²
54.	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
55.	T1	CUSTOM	CUSTOM	Lp= 1.597 mH Rp= 870.0 mOhm Leakage_L= 31.931 μ H Ns1toNp= 0.077 Rs1= 8.6 mOhms Ns2toNp= 0.086 Rs2= 700.0 μ Ohms	1	NA	CUSTOM 0 mm ²
56.	U1	Texas Instruments	UCC28C42DR	Switcher	1	\$0.60	 D0008A 57 mm ²
57.	VR	Texas Instruments	TL431AIDBZR	Voltage References	1	\$0.08	 DBZ0003A 14 mm ²

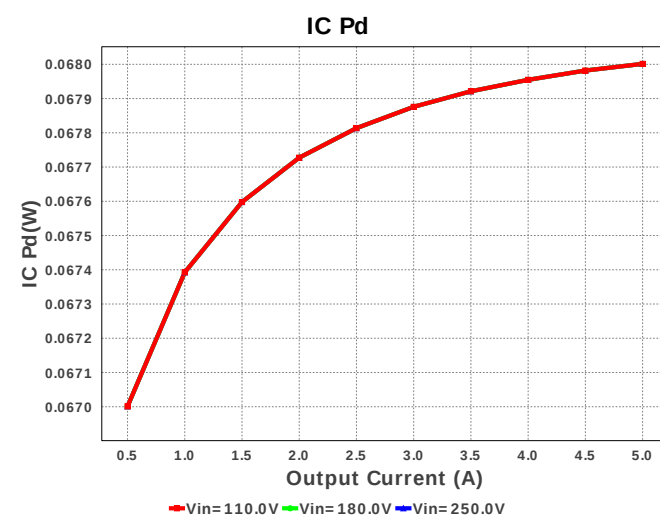
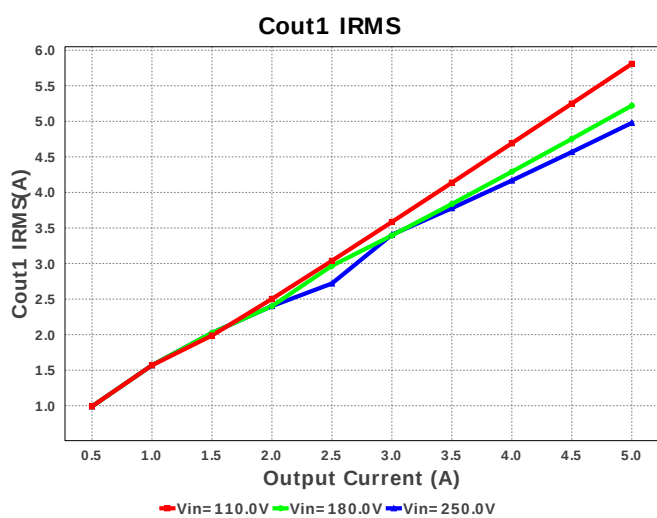
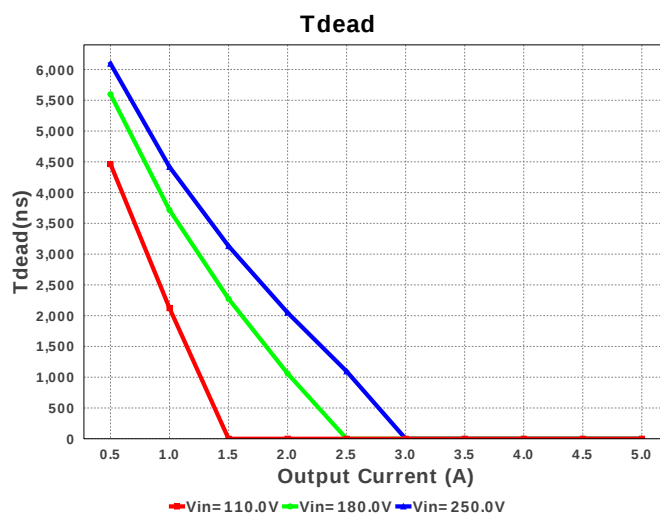
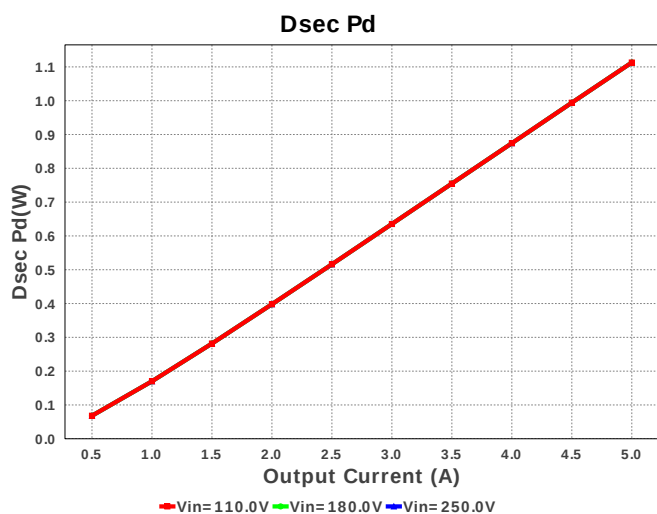
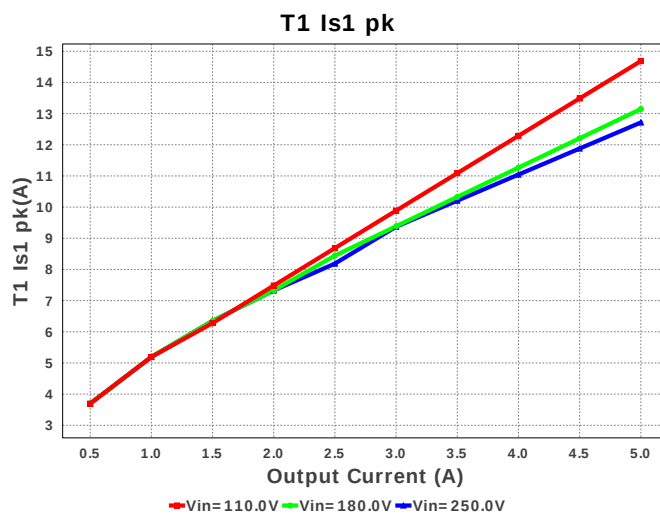
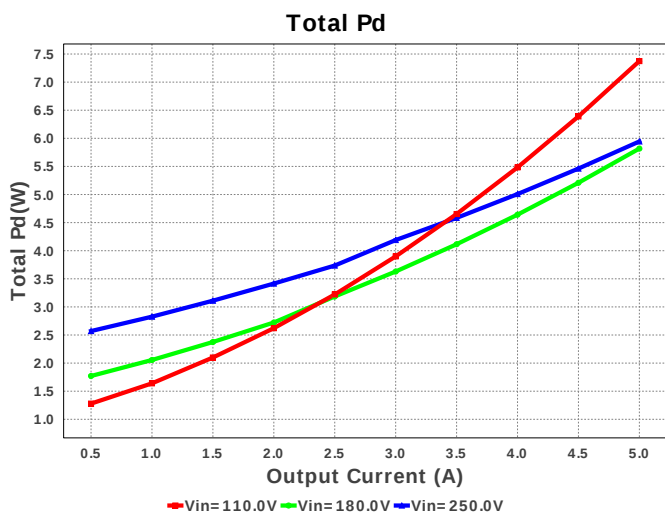


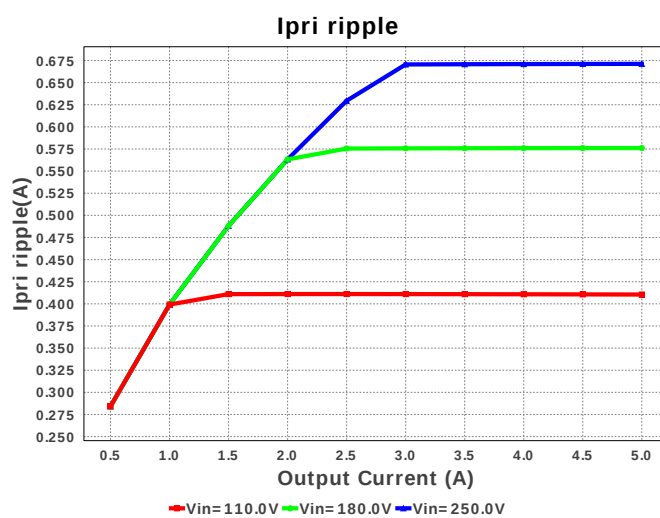
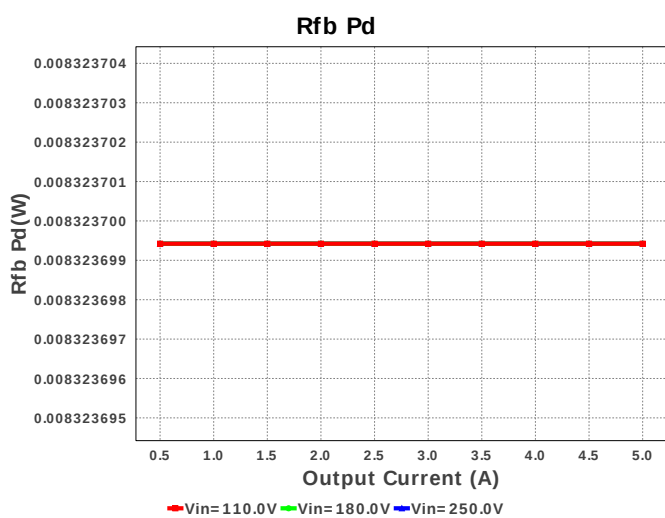
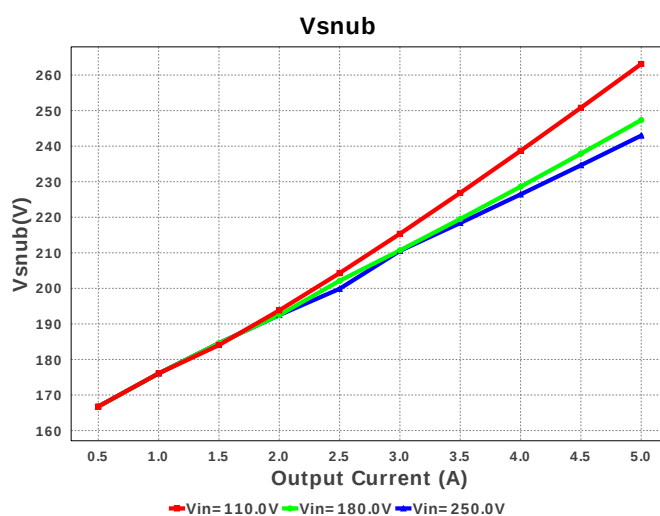
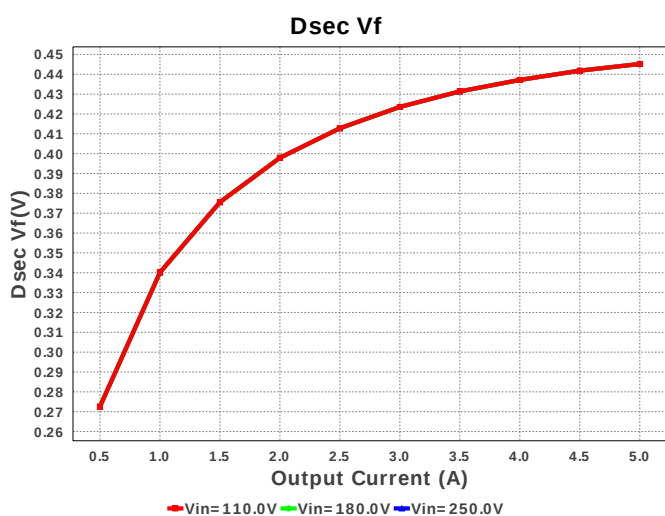
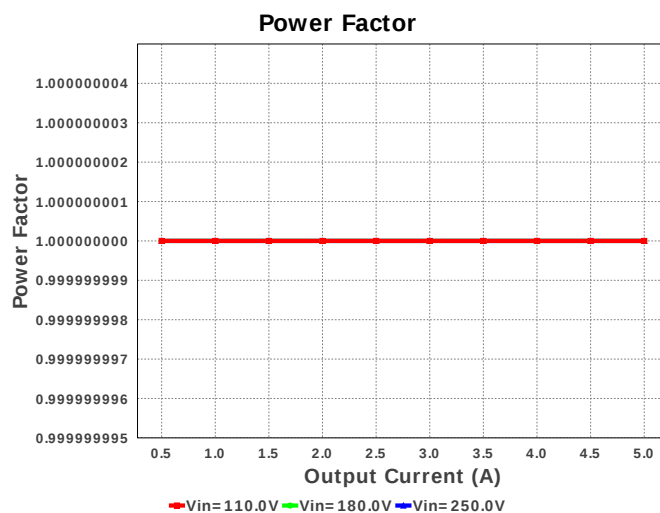
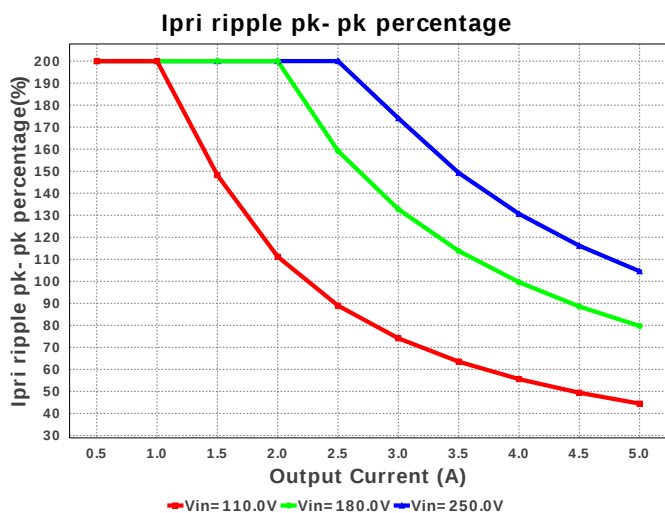


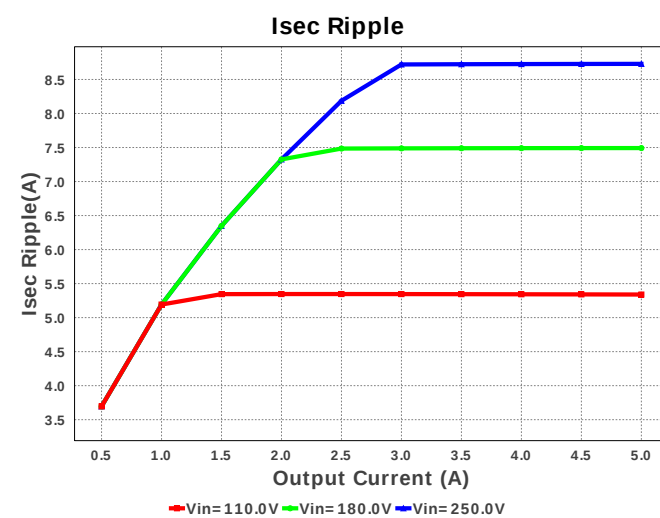
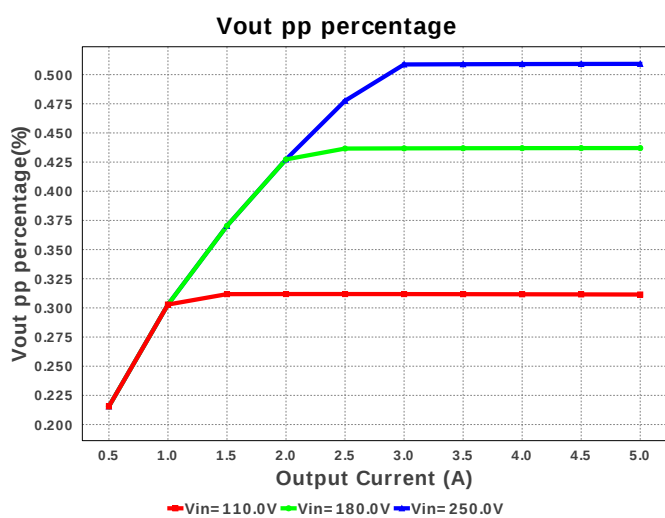
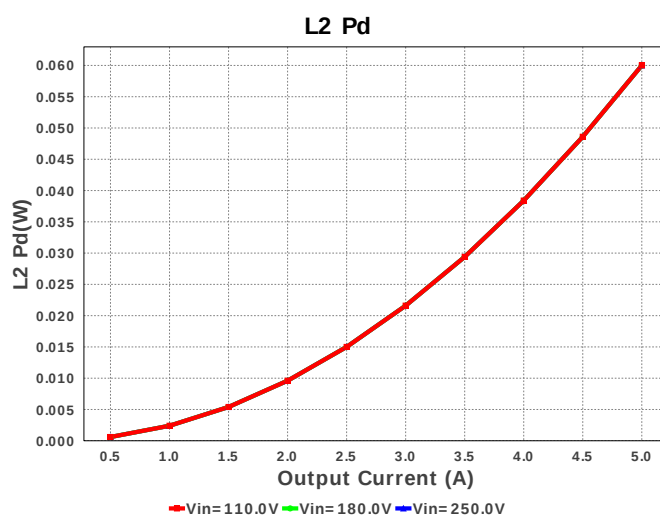
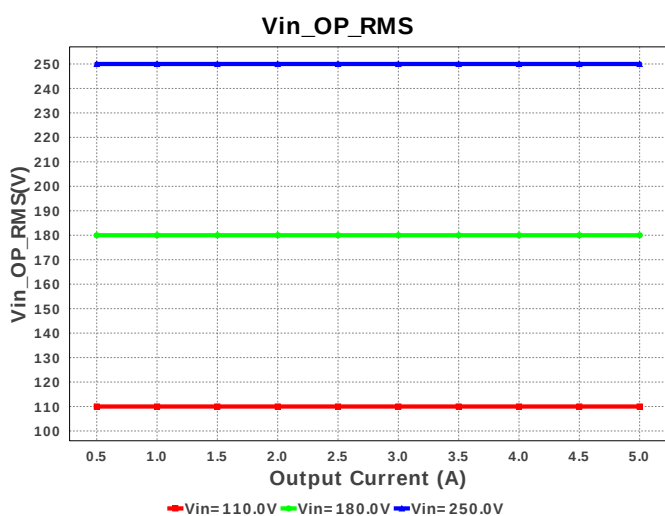
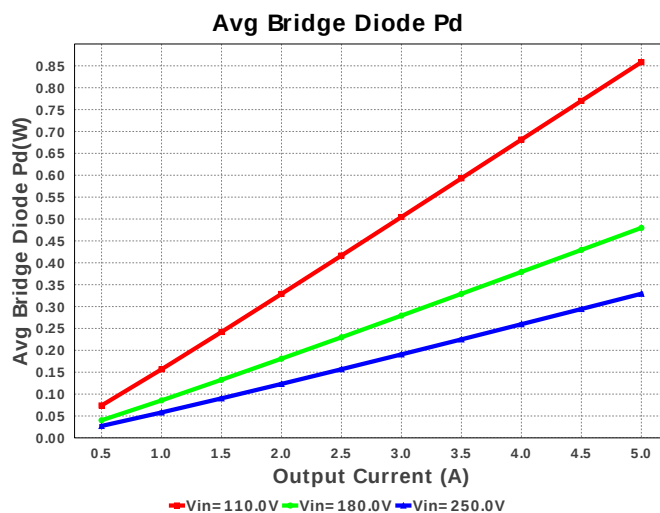
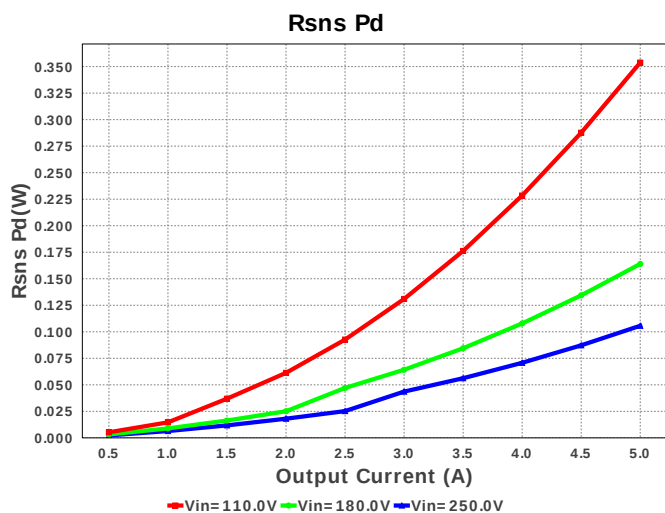


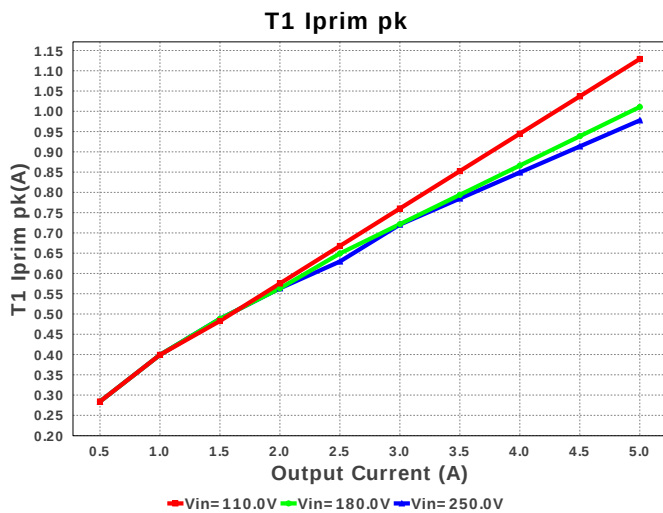
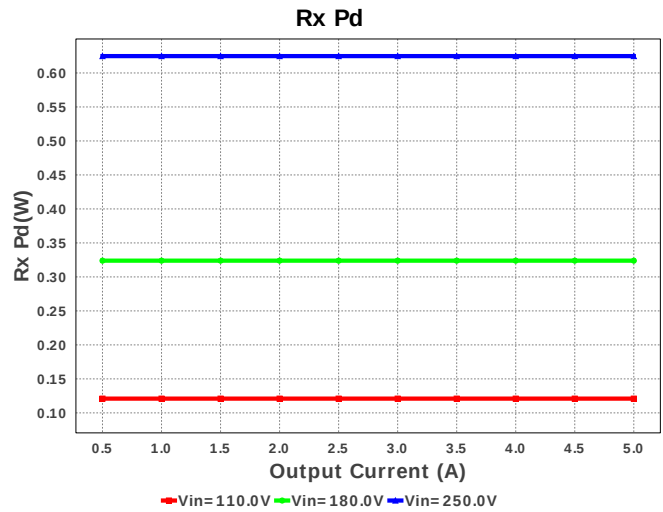
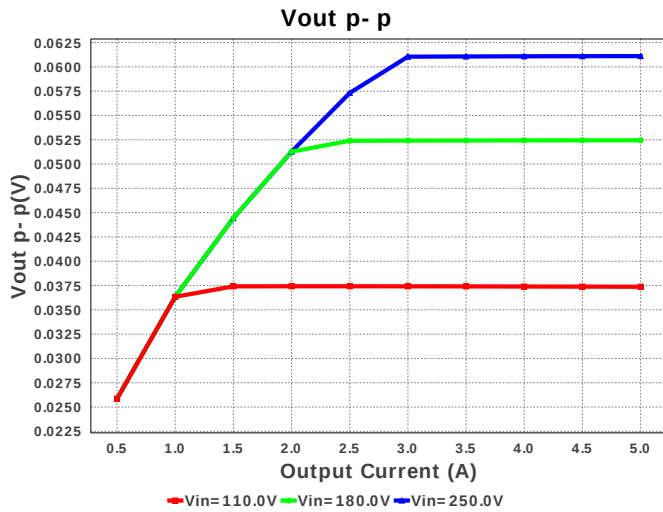












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	5.808 A	Current	Output capacitor1 RMS ripple current
2.	Iin rms	612.49 mA	Current	RMS Input Current
3.	Iout_DCM	1.126 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	554.015 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	410.529 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	44.439 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	5.339 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	721.263 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	1.129 A	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	7.664 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	14.684 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	16.7 ns	General	Auxiliary Diode Reverse Recovery Time
15.	Dsec Vf	445.177 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	445.177 mV	General	Effective Forward Voltage Drop at the Operating Current
18.	Dsnub trr	35.0 ns	General	Snubber Diode Reverse Recovery Time
19.	FootPrint	4.515 k mm ²	General	Total Foot Print Area of BOM components
20.	Frequency	98.851 kHz	General	Switching frequency
21.	Pout	60.0 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	4.21 us	General	Approximate Converter Off Time
25.	Ton Act	6.067 us	General	Approximate Converter On Time
26.	Total BOM	\$0.0	General	Total BOM Cost
27.	Tsw	10.116 us	General	Switching Time Period
28.	Vaux	13.941 V	General	Auxiliary Voltage
29.	Vsnub	263.117 V	General	Voltage Across the Snubber

#	Name	Value	Category	Description
30.	Vout Actual	11.99 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
31.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
32.	Duty Cycle	59.971 %	Op_point	Duty cycle
33.	Efficiency	89.055 %	Op_point	Steady state efficiency
34.	IC Tj	33.4 degC	Op_point	IC junction temperature
35.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
36.	IOUT_OP	5.0 A	Op_point	Iout operating point
37.	M1 TJOP	66.114 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	37.375 mV	Op_point	Peak-to-peak output ripple voltage
41.	Avg Bridge Diode Pd	858.358 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
42.	Cbulk Pd	1.375 W	Power	Bulk capacitor power dissipation
43.	Cout1 Pd	236.135 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	1.113 W	Power	Secondary Diode Power Dissipation
47.	Dsec2 Pd	1.113 W	Power	Secondary Diode Power Dissipation
48.	IC Pd	68.001 mW	Power	IC power dissipation
49.	L1 Pd	24.025 mW	Power	Power Dissipation in the Inductor
50.	L2 Pd	60.0 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
51.	M1 Pd	577.825 mW	Power	M1 MOSFET total power dissipation
52.	Paux	20.99 mW	Power	Power Dissipation in Raux and Daux
53.	Pd Rstartup	179.462 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
54.	Rdrv Pd	33.815 μ W	Power	Power Dissipation in Gate Drive Resistor
55.	Rfb Pd	8.324 mW	Power	Rfb Power Dissipation
56.	Rsns Pd	353.75 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	1.244 W	Power	Snubber Power Dissipation
59.	T1 Pd	1.915 W	Power	Estimated Losses in Transformer
60.	Total Pd	7.374 W	Power	Total Power Dissipation
61.	Vout Tolerance	1.926 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
62.	Vout pp percentage	311.456 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	Iout1	5.0	Output Current #1
3.	VinMax	250.0	Maximum input voltage
4.	VinMin	110.0	Minimum input voltage
5.	Vout	12.0	Output Voltage
6.	Vout1	12.0	Output Voltage #1
7.	Vout2	5.0	Output Voltage #2
8.	line_fsw	50.0	Light Output in Lumen
9.	base_pn	UCC28C42	Base Product Number
10.	source	AC	Input Source Type
11.	Ta	30.0	Ambient temperature

Design Assistance

1. **UCC28C42** Product Folder : <http://www.ti.com/product/UCC28C42> : contains the data sheet and other resources.

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