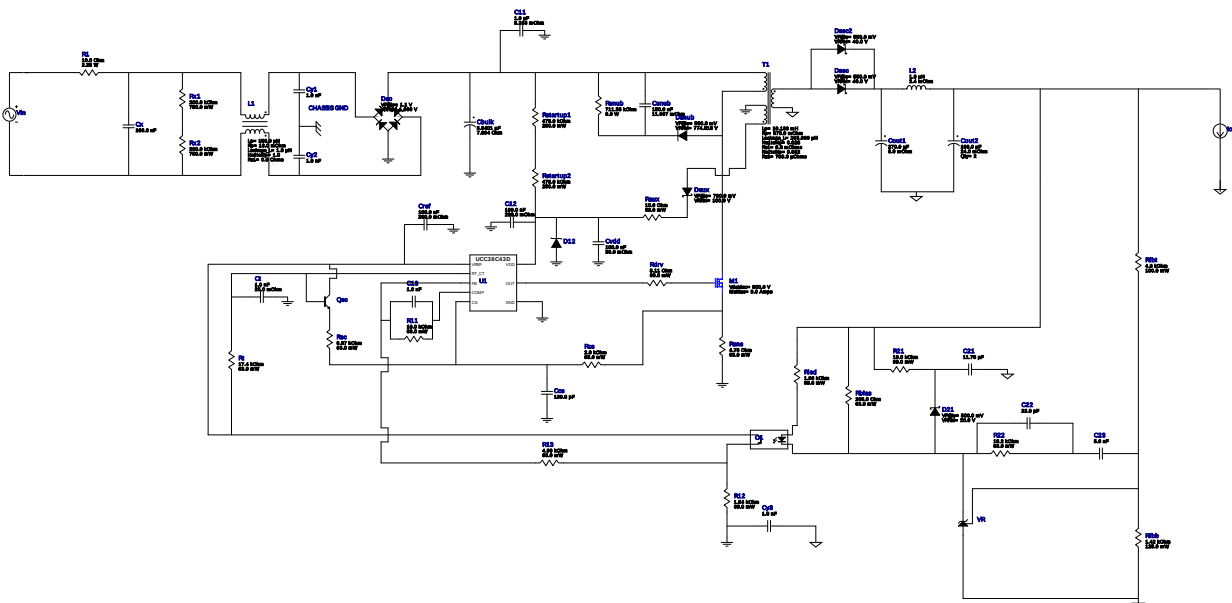


WEBENCH® Design Report

Design : 4766793/2 UCC38C43DR
UCC38C43DR 220.0V-230.0V to 5.00V @ 2.0A

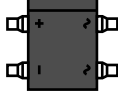
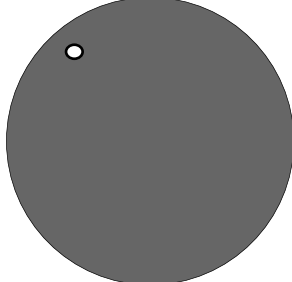
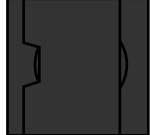


1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.

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	CUSTOM	CUSTOM Series= ?	Cap= 11.75 uF VDC= 10.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 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	CC0805KRX7R9BB562 Series= X7R	Cap= 5.6 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
7.	Cbulk	CUSTOM	CUSTOM Series= ?	Cap= 5.3401 uF ESR= 7.6943 Ohm VDC= 390.32 V IRMS= 110.3 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

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cout1	Panasonic	16SVPG270M Series= ?	Cap= 270.0 uF ESR= 8.0 mOhm VDC= 16.0 V IRMS= 5.8 A	1	\$0.70	 CAPSMT_62_C10 74 mm²
10.	Cout2	Panasonic	16SVPC100M Series= SVPC	Cap= 100.0 uF ESR= 24.0 mOhm VDC= 16.0 V IRMS= 2.49 A	2	\$0.29	 SM_RADIAL_6.3AMM 80 mm²
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 mm²
12.	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 mm²
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 mm²
14.	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 mm²
15.	Cx	TDK	B32913A5104M000 Series= 2231	Cap= 100.0 nF VDC= 1000.0 V IRMS= 0.0 A	1	\$0.46	 B32913_2650x600x1500 228 mm²
16.	Cy1	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm²
17.	Cy2	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm²
18.	Cy3	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	\$0.22	 B81123_1800x500x1050 140 mm²

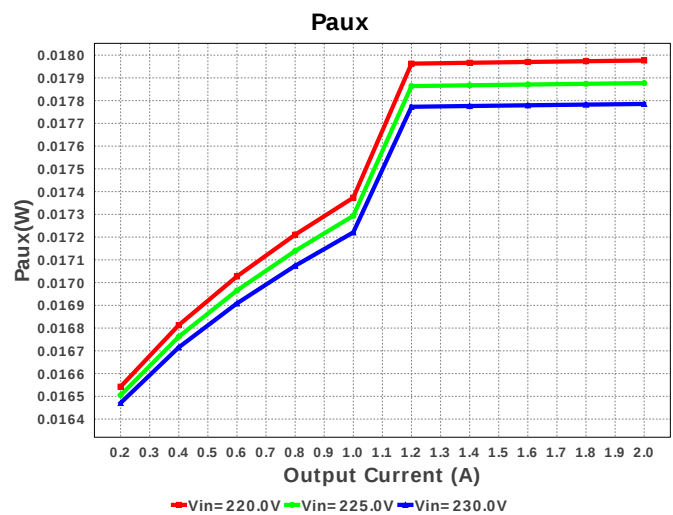
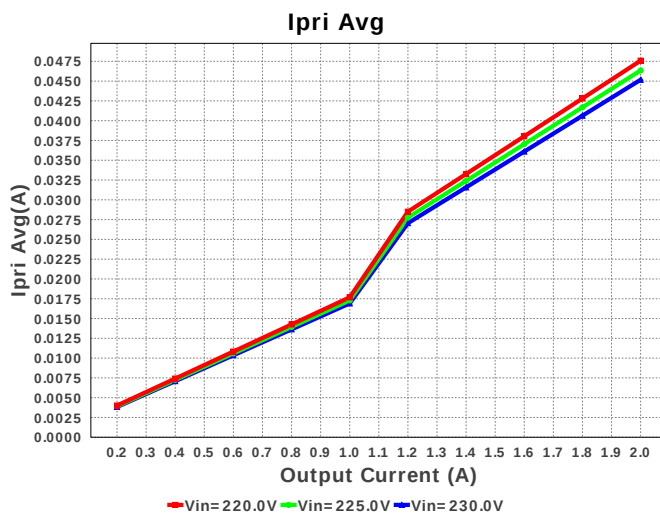
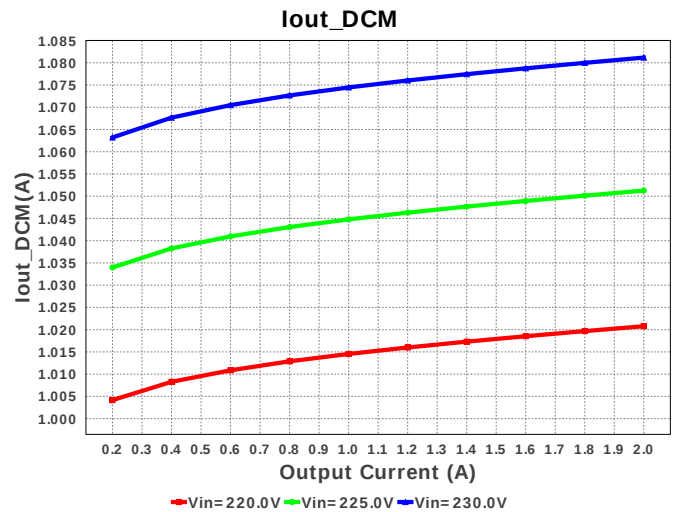
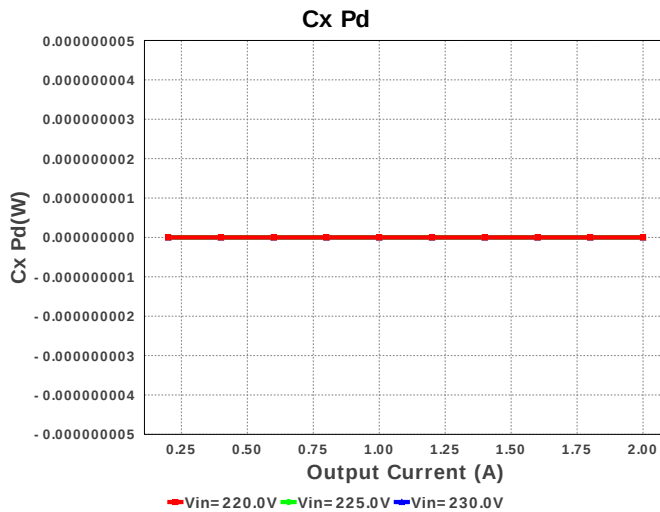
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19.	D12	Diodes Inc.	MMSZ5248B-7-F	Zener	1	\$0.04	 SOD-123 13 mm ²
20.	D21	Vishay-Semiconductor	SS12-E3/61T	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMA 37 mm ²
21.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	\$0.24	 DF-S 99 mm ²
22.	Daux	Diodes Inc.	B1100-13-F	VF@Io= 790.0 mV VRRM= 100.0 V	1	\$0.10	 SMA 37 mm ²
23.	Dsec	Diodes Inc.	B540C-13-F	VF@Io= 550.0 mV VRRM= 40.0 V	1	\$0.17	 SMC 83 mm ²
24.	Dsec2	Diodes Inc.	B540C-13-F	VF@Io= 550.0 mV VRRM= 40.0 V	1	\$0.17	 SMC 83 mm ²
25.	Dsnub	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 774.613 V	1	NA	CUSTOM 0 mm ²
26.	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
27.	L2	Coilcraft	SER1360-182KLB	L= 1.8 μ H DCR= 2.4 mOhm	1	\$0.72	 SER1360 225 mm ²
28.	M1	STMicroelectronics	STF10N80K5	VdsMax= 800.0 V IdsMax= 9.0 Amps	1	\$2.52	 TO-220FP 79 mm ²
29.	O1	Vishay-Semiconductor	TCMT1109	Optocoupler	1	\$0.21	 SOP-4 44 mm ²
30.	Qsc	STMicroelectronics	2N2222A	Bipolar Transistor	1	NA	 TO-18 57 mm ²
31.	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
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	CRCW04021K54FKED Series= CRCW..e3	Res= 1.54 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

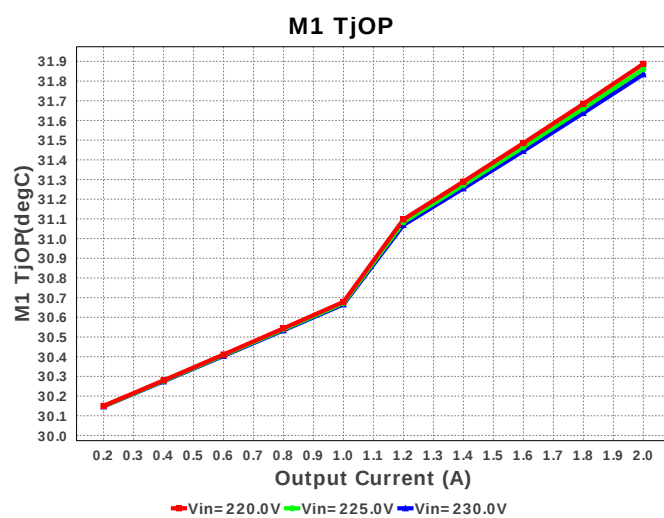
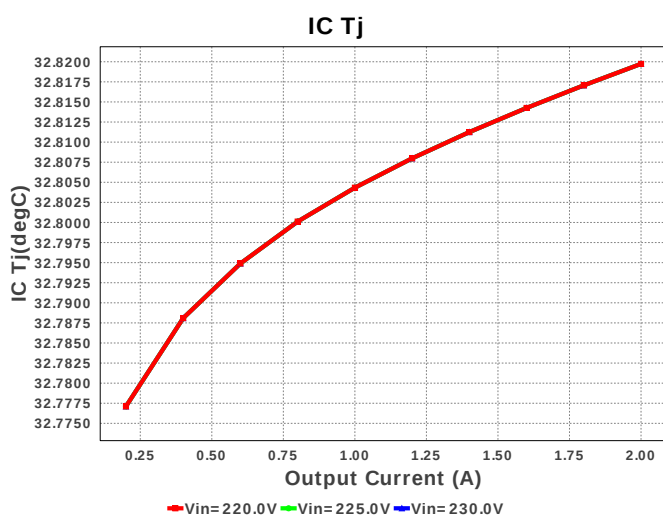
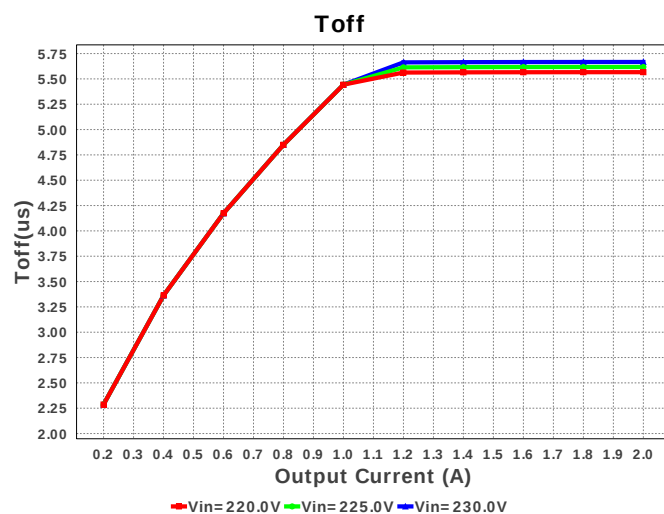
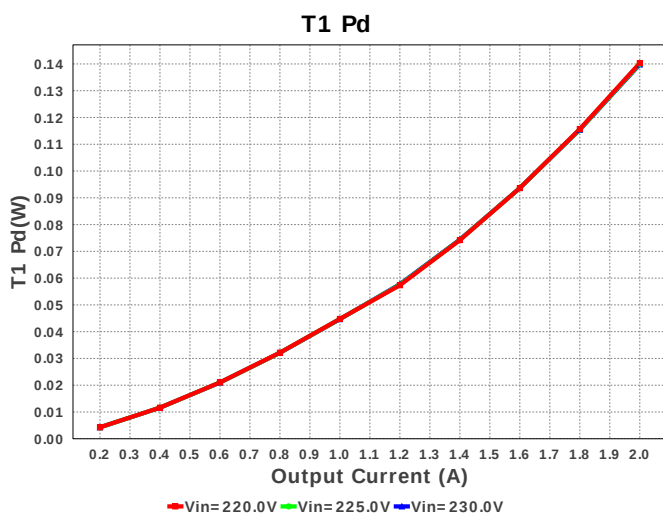
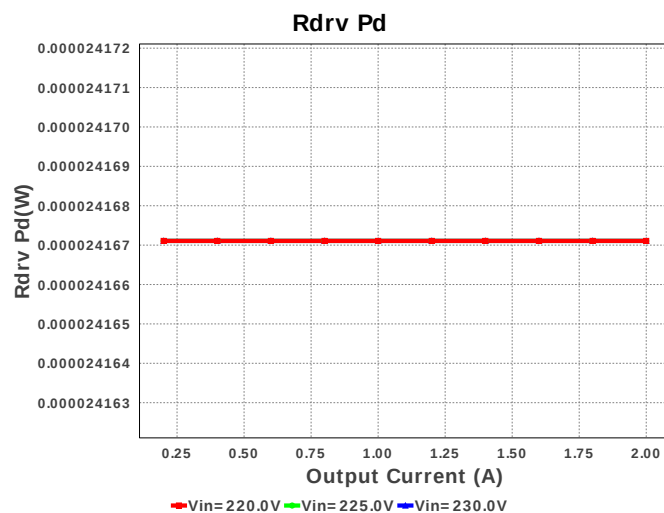
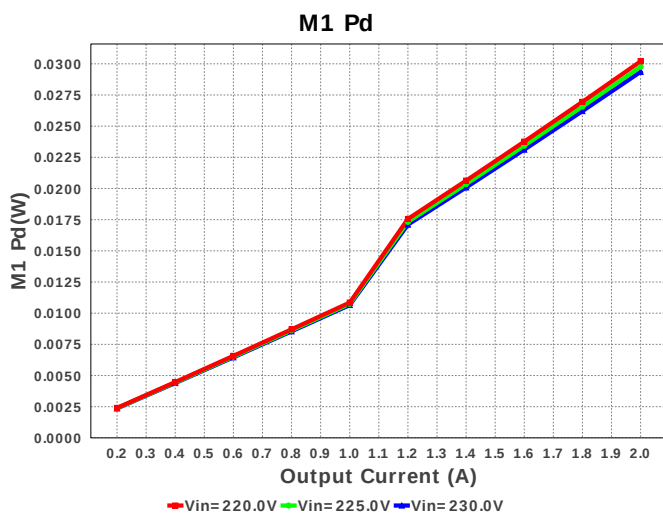
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
35.	R21	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
36.	R22	Vishay-Dale	CRCW040218K2FKED Series= CRCW..e3	Res= 18.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
37.	Raux	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
38.	Rbias	Vishay-Dale	CRCW0402205RFBED Series= CRCW..e3	Res= 205.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
39.	Rcs	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
40.	Rdrv	Vishay-Dale	CRCW04025R11FKED Series= CRCW..e3	Res= 5.11 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
41.	Rfbb	Yageo America	RT0805BRD071K42L Series= RT0805	Res= 1.42 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.05	 0805 7 mm²
42.	Rfbb	Yageo America	RC0603FR-074K3L Series= ?	Res= 4.3 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm²
43.	Rled	Vishay-Dale	CRCW04021K96FKED Series= CRCW..e3	Res= 1.96 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
44.	Rsc	Vishay-Dale	CRCW04028K87FKED Series= CRCW..e3	Res= 8.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
45.	Rsns	Vishay-Dale	CRCW04024R75FKED Series= CRCW..e3	Res= 4.75 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
46.	Rsns	CUSTOM	CUSTOM Series= ?	Res= 711.35 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm²
47.	Rstart1	Panasonic	ERJ-8ENF4753V Series= ERJ-8E	Res= 475.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
48.	Rstart2	Panasonic	ERJ-8ENF4753V Series= ERJ-8E	Res= 475.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
49.	Rt	Vishay-Dale	CRCW040217K4FKED Series= CRCW..e3	Res= 17.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
50.	Rx1	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm²
51.	Rx2	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm²
52.	T1	CUSTOM	CUSTOM	Lp= 10.199 mH Rp= 870.0 mOhm Leakage_L= 203.989 µH Ns1toNp= 0.028 Rs1= 8.6 mOhms Ns2toNp= 0.062 Rs2= 700.0 µOhms	1	NA	CUSTOM 0 mm²

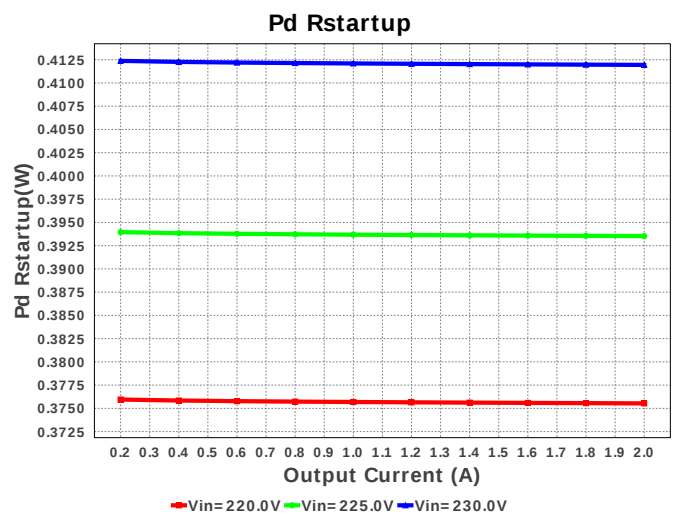
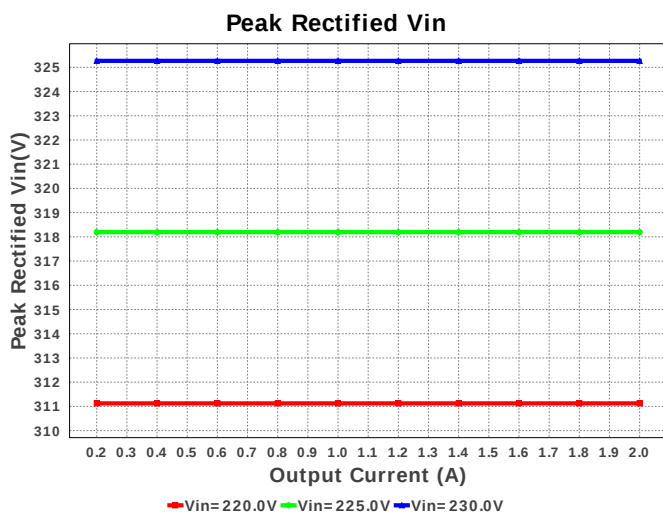
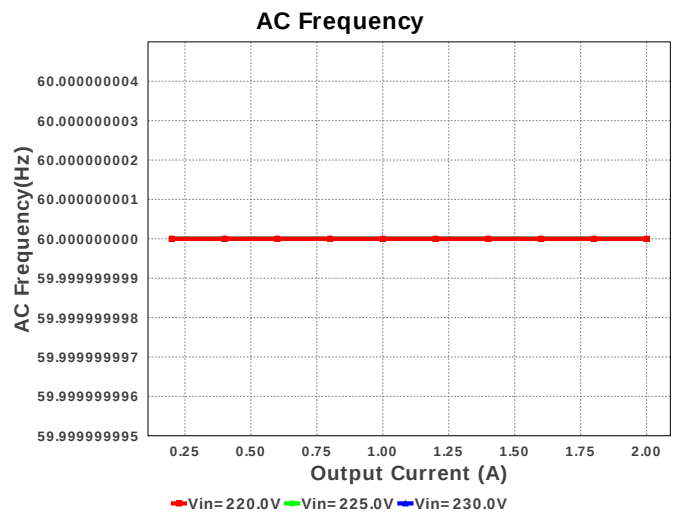
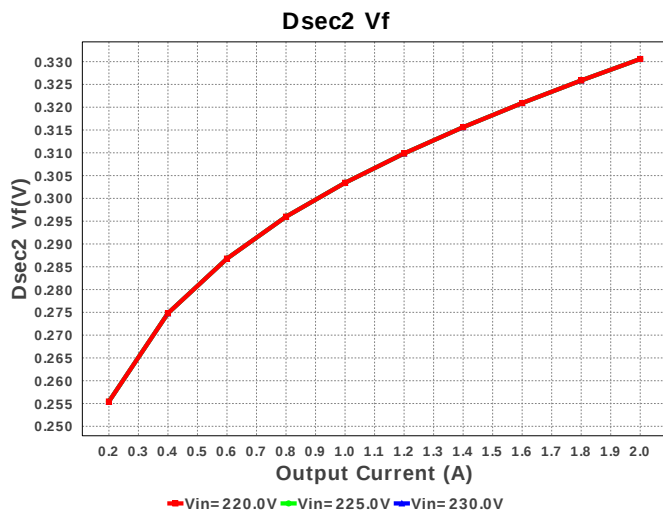
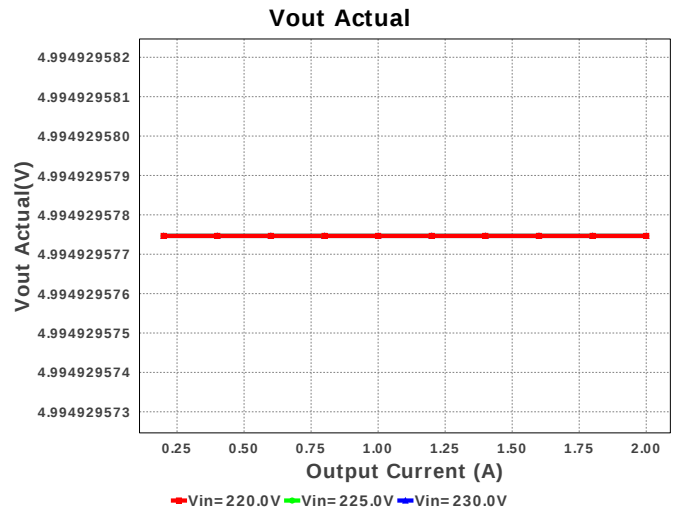
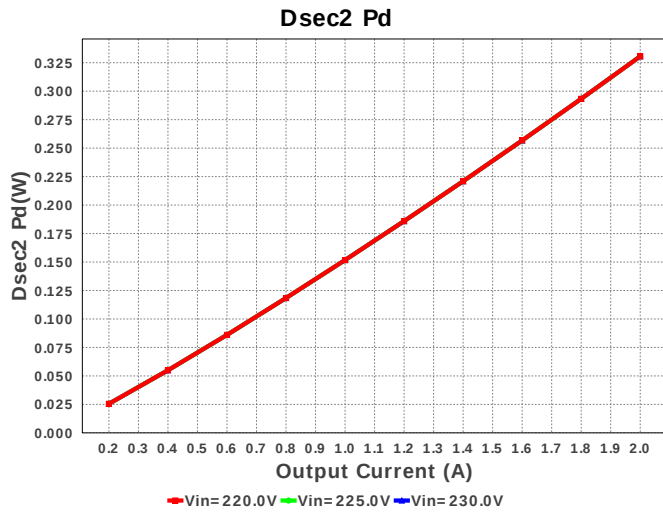
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
53. U1		Texas Instruments	UCC38C43DR	Switcher	1	\$0.60	

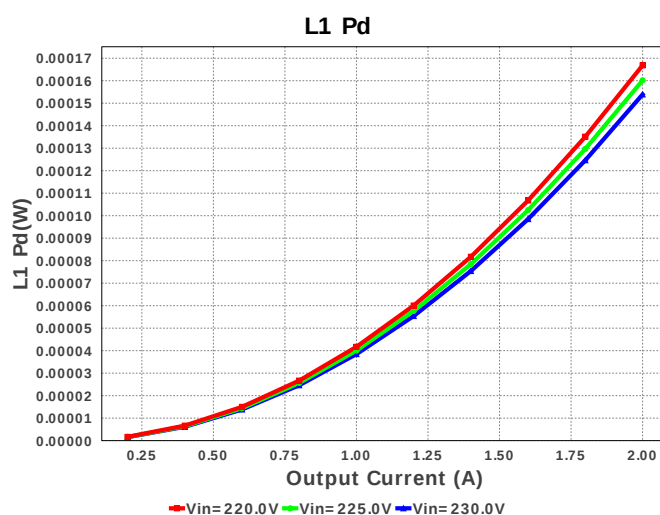
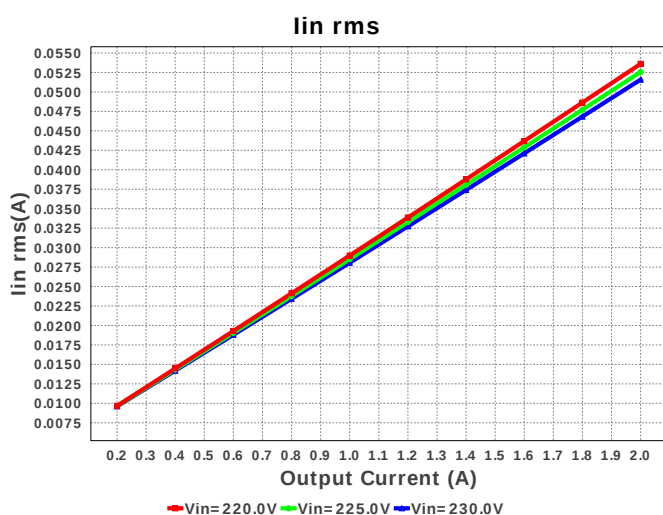
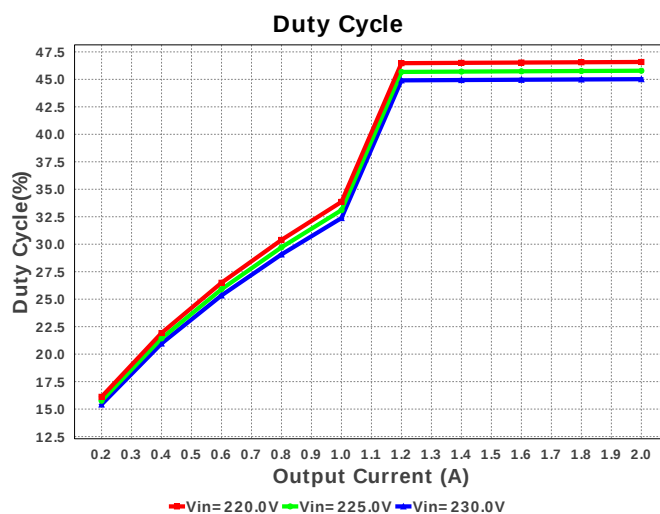
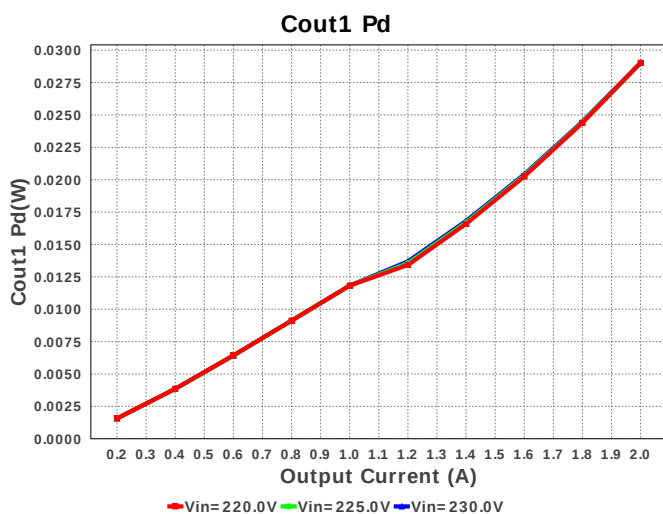
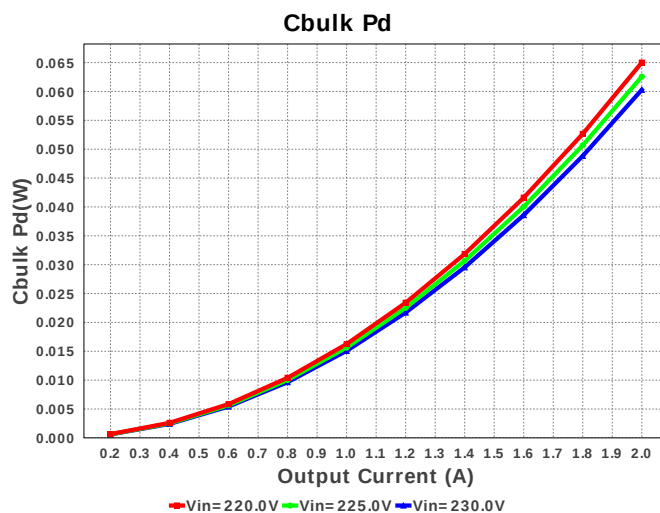
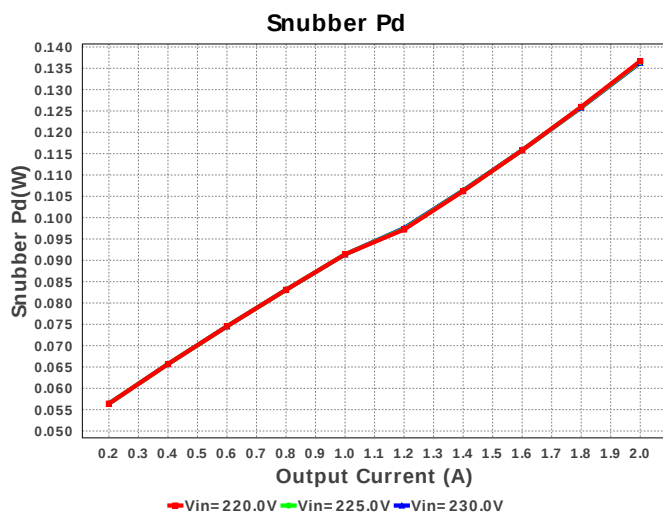
D0008A 57 mm²

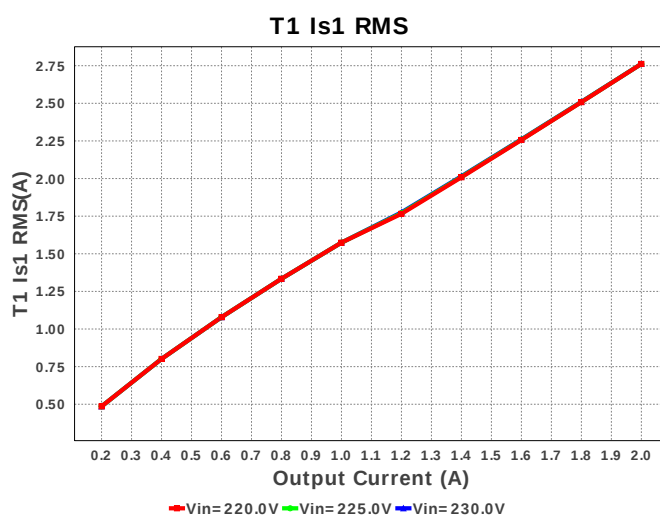
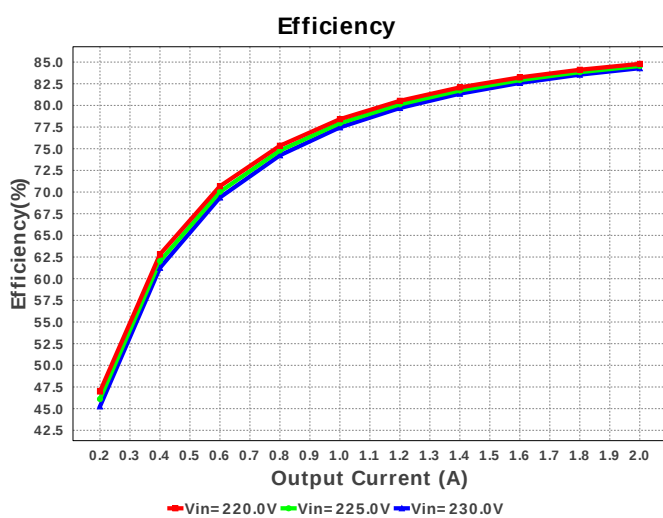
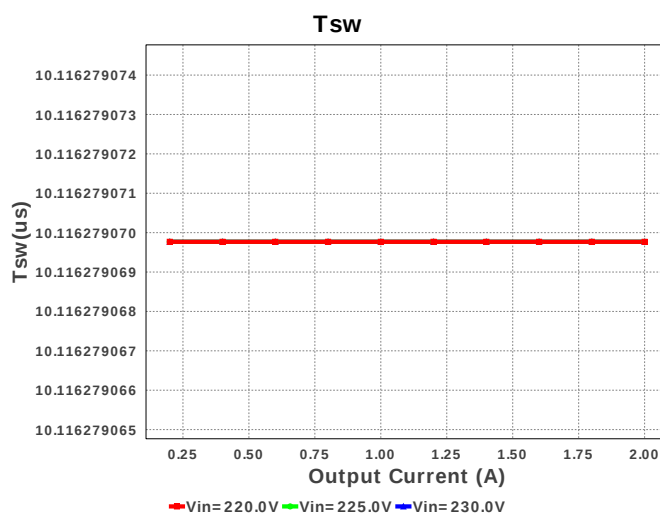
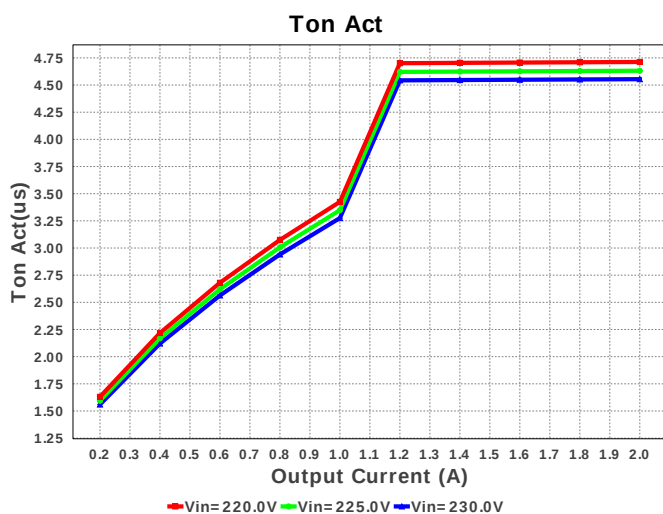
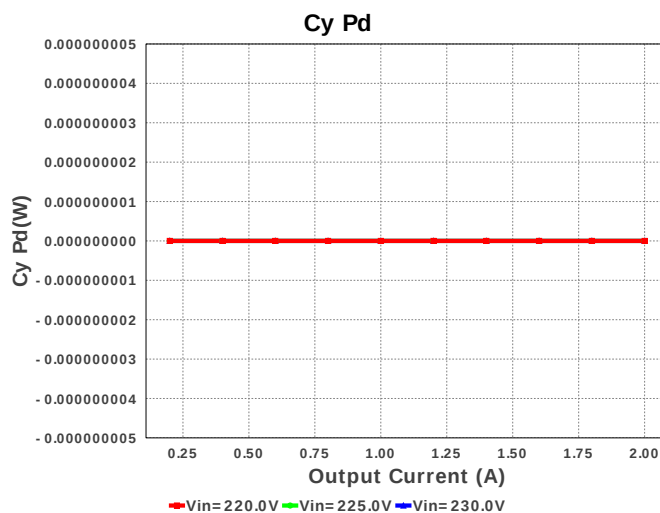
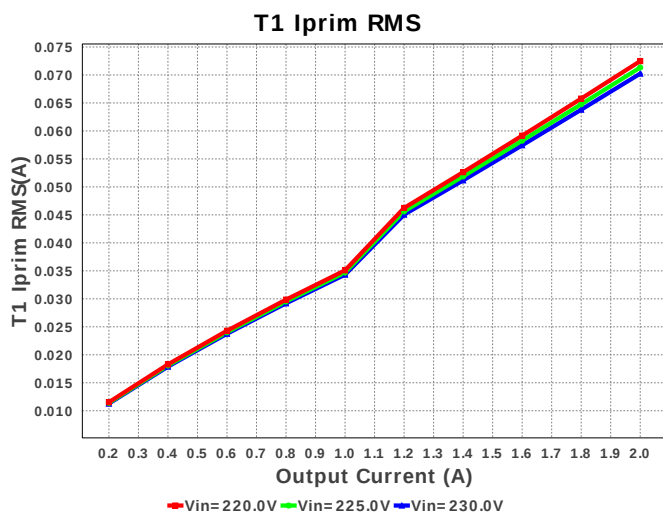
54. VR		Texas Instruments	LMV431CM5/NOPB	Voltage References	1	\$0.16	
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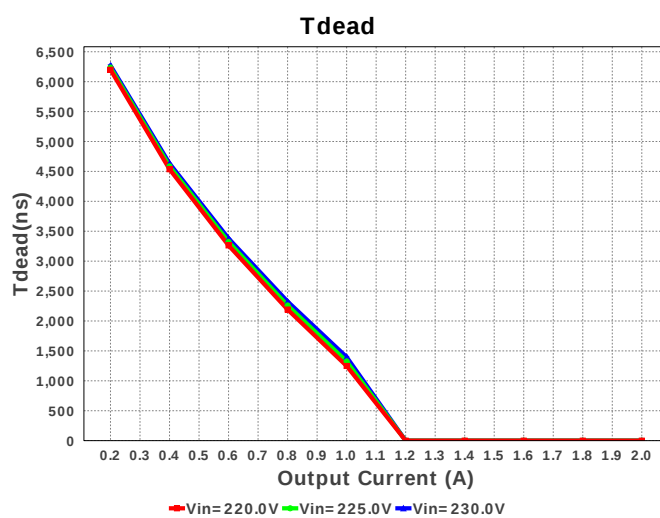
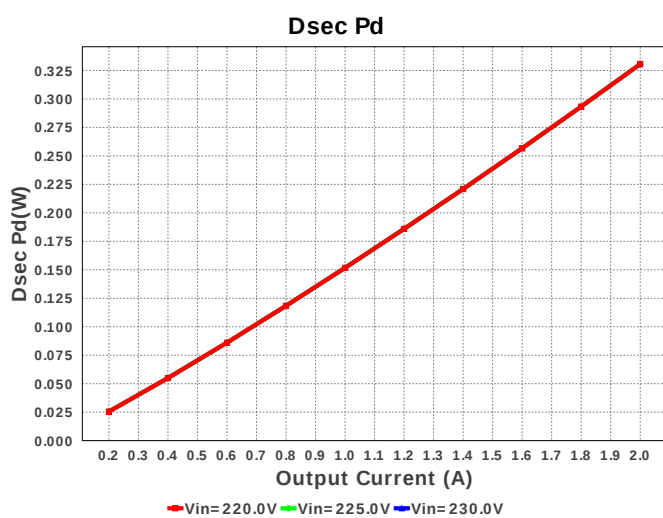
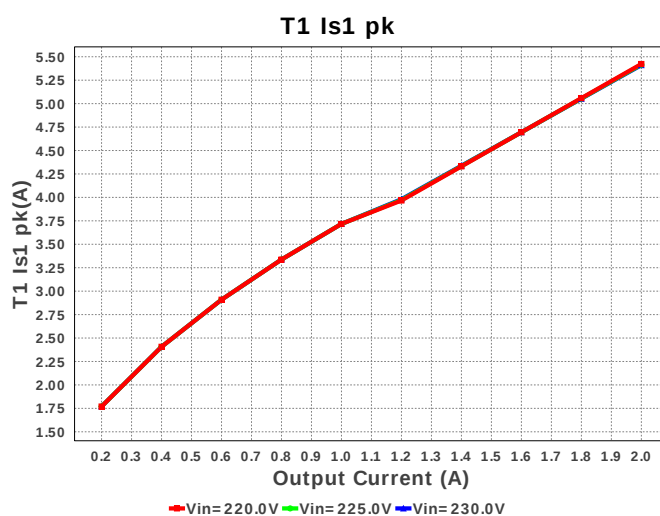
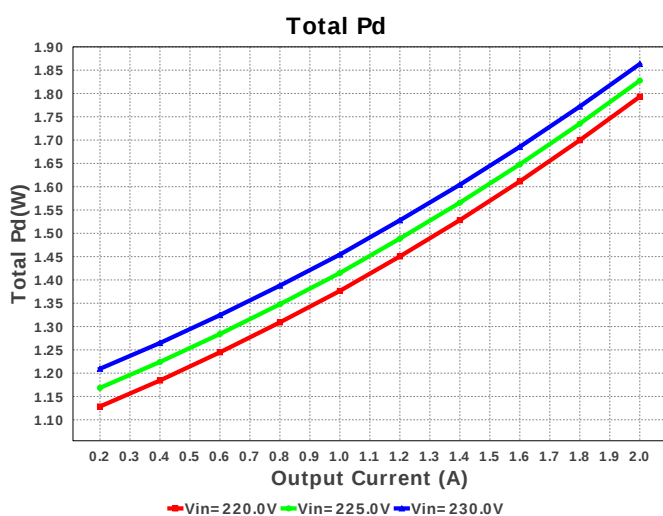
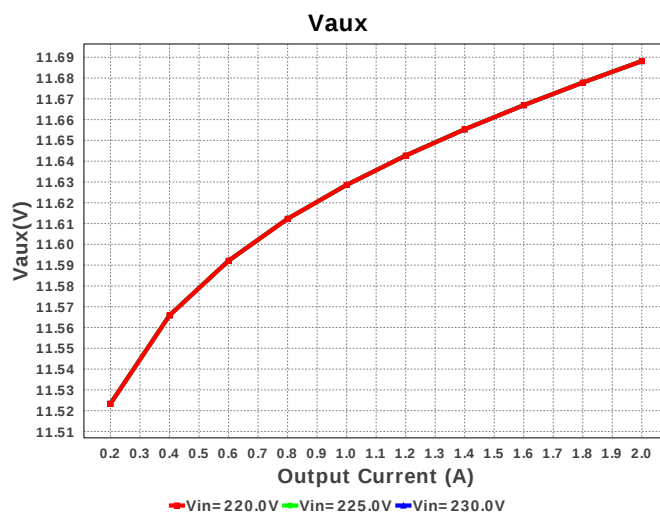
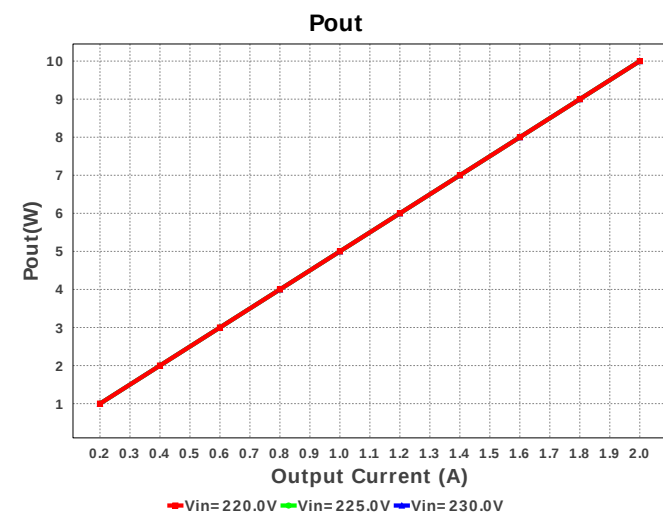
R-PDSO-G3 16 mm²



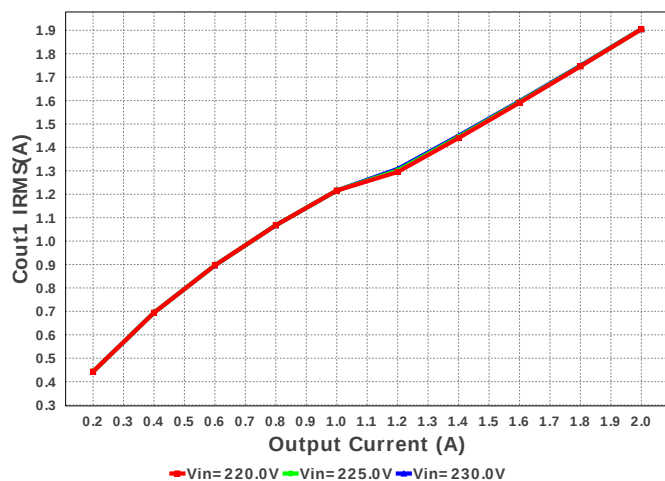




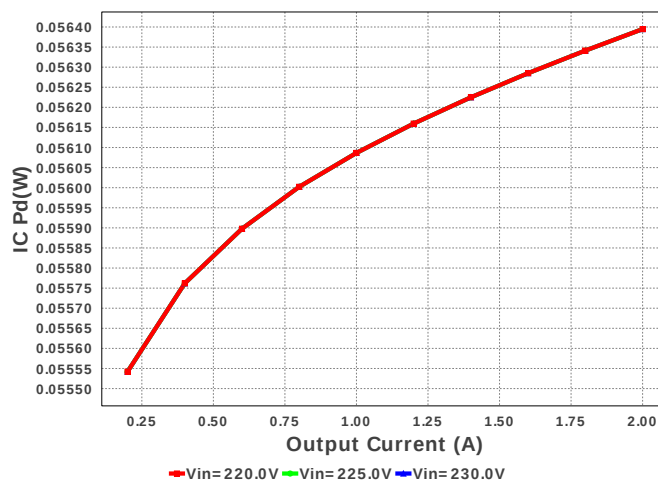




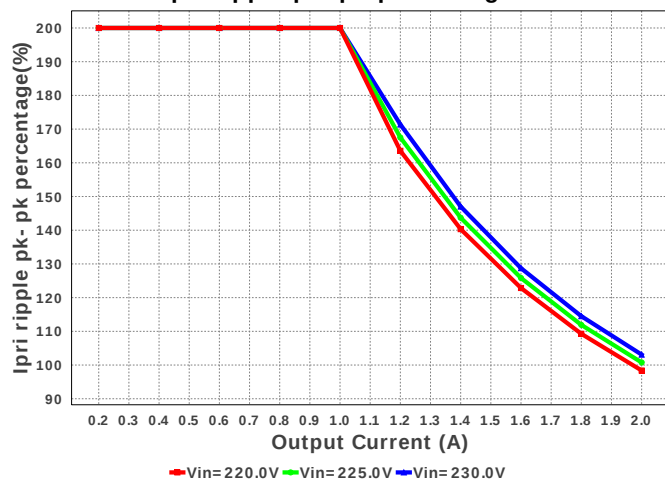
Cout1 IRMS



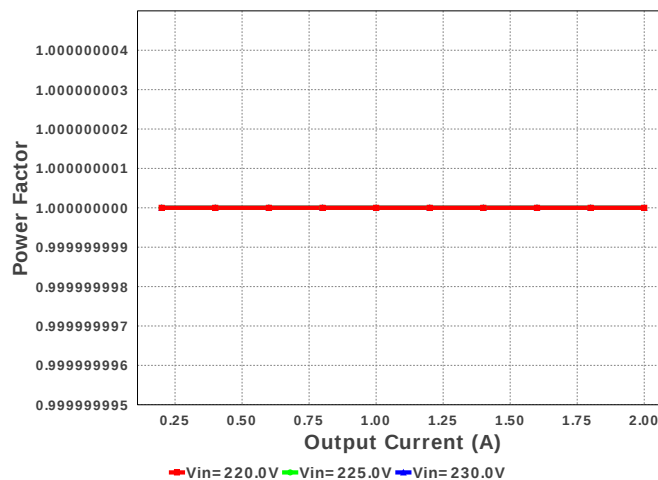
IC Pd



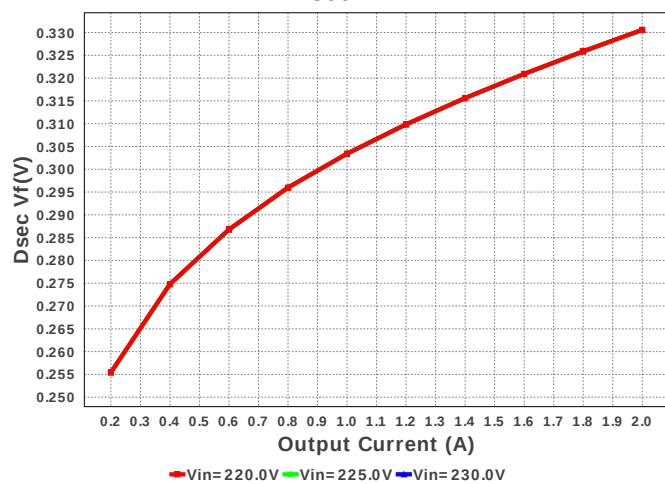
Ipri ripple pk- pk percentage



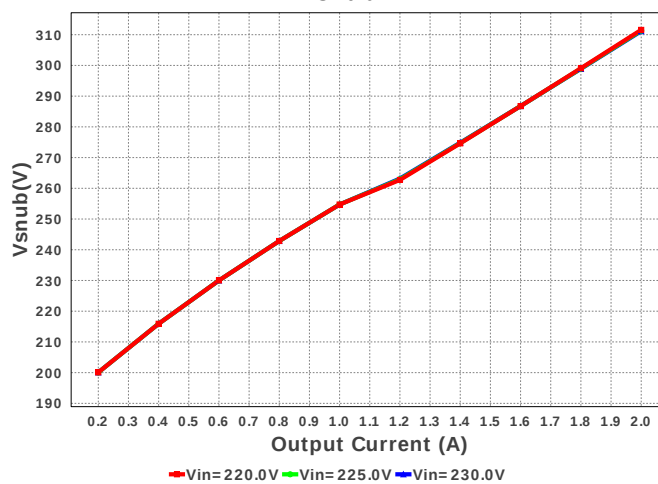
Power Factor

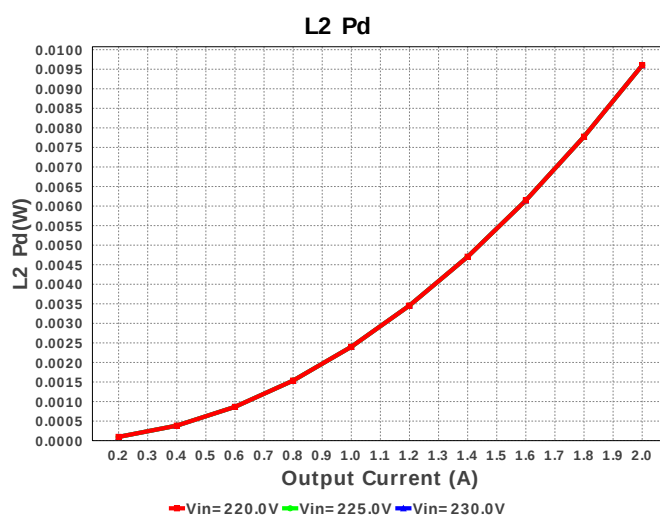
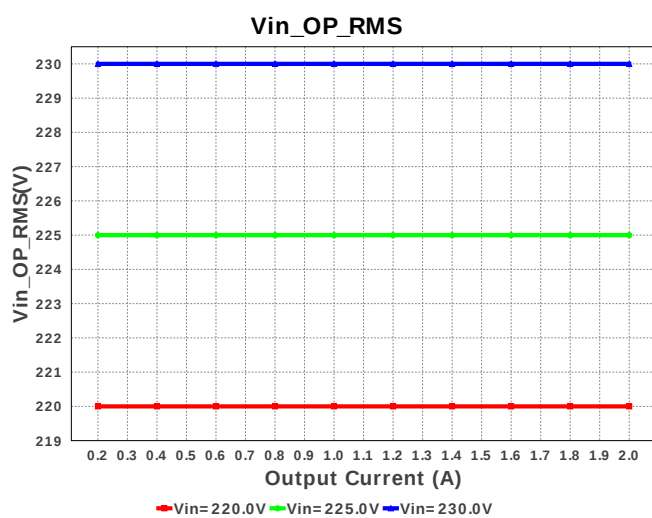
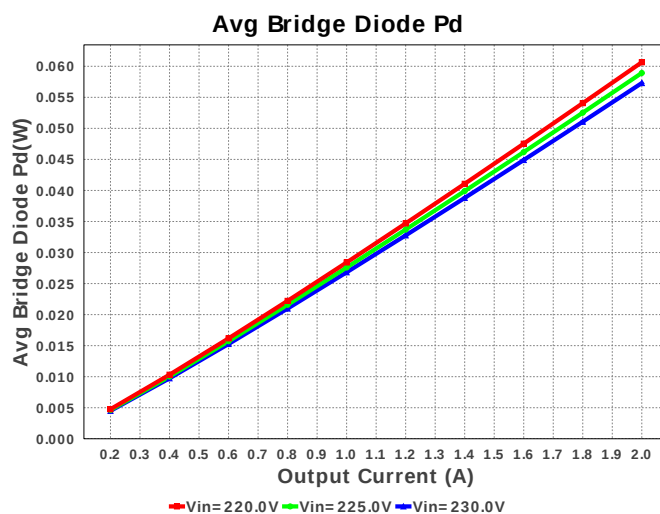
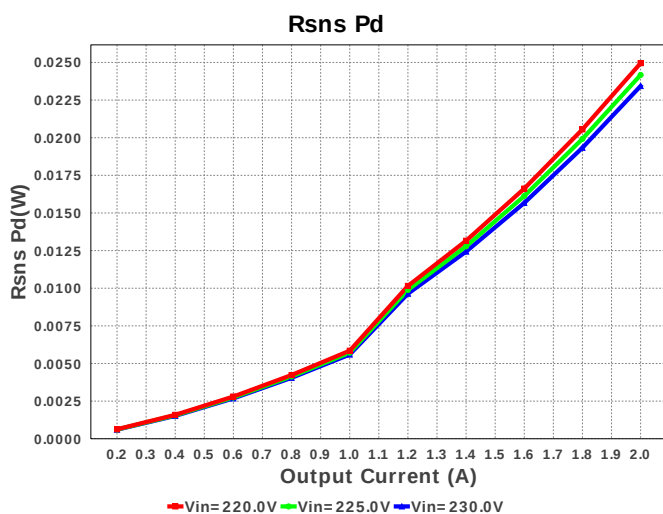
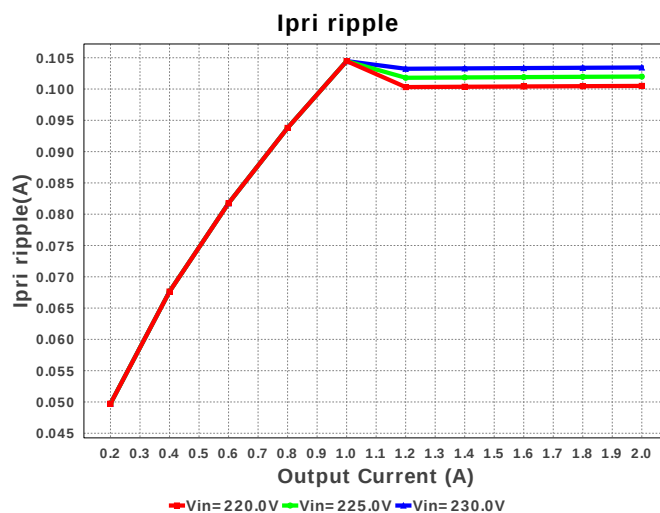
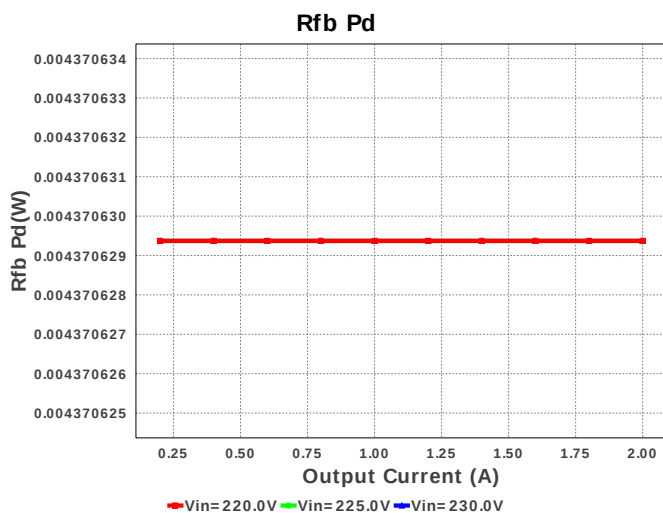


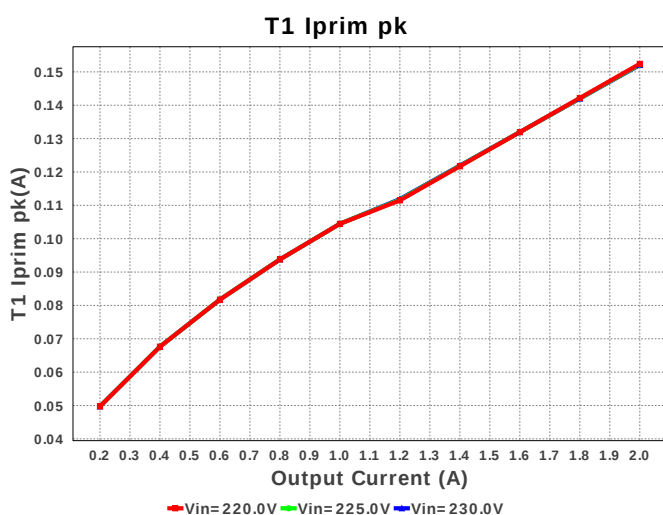
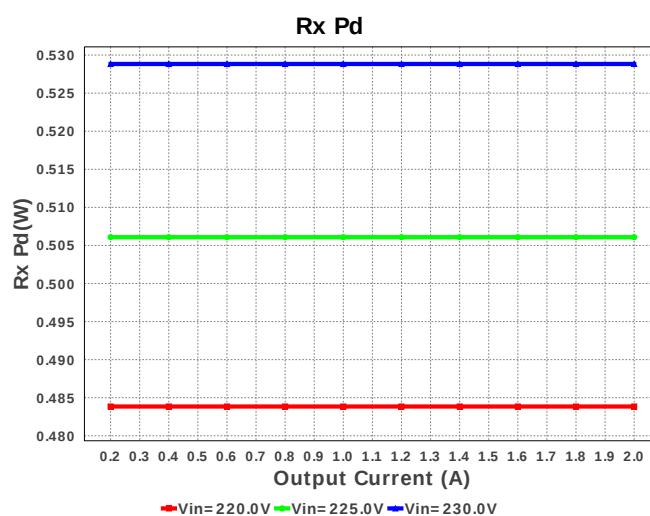
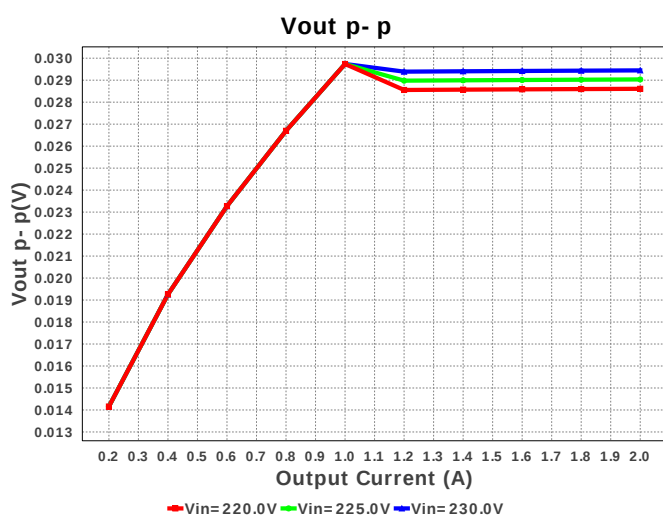
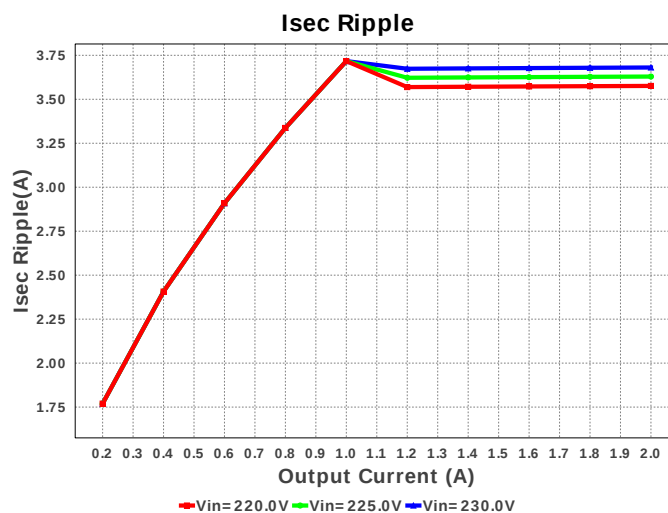
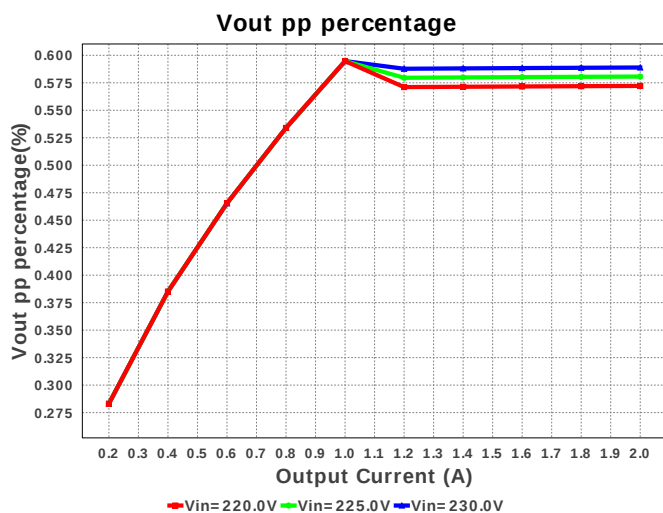
Dsec Vf



Vsnub







Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	1.904 A	Current	Output capacitor1 RMS ripple current
2.	Iin rms	53.605 mA	Current	RMS Input Current
3.	Iout_DCM	1.021 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	47.584 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	100.497 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	98.379 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	3.576 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	72.477 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	152.401 mA	Current	Transformer Primary Peak Current

#	Name	Value	Category	Description
10.	T1 Is1 RMS	2.762 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	5.423 A	Current	Transformer Secondary1 Peak Current
12.	AC Frequency	50.0 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	330.58 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	330.58 mV	General	Effective Forward Voltage Drop at the Operating Current
18.	Dsnub trr	0.0 ns	General	Snubber Diode Reverse Recovery Time
19.	FootPrint	2.985 k mm ²	General	Total Foot Print Area of BOM components
20.	Frequency	98.851 kHz	General	Switching frequency
21.	Mode	CCM	General	Conduction Mode
22.	Pout	10.0 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	5.566 us	General	Approximate Converter Off Time
26.	Ton Act	4.712 us	General	Approximate Converter On Time
27.	Total BOM	\$0.0	General	Total BOM Cost
28.	Tsw	10.116 us	General	Switching Time Period
29.	Vaux	11.688 V	General	Auxiliary Voltage
30.	Vsnub	311.572 V	General	Voltage Across the Snubber
31.	Vout Actual	4.995 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
32.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
33.	Duty Cycle	46.581 %	Op_point	Duty cycle
34.	Efficiency	84.795 %	Op_point	Steady state efficiency
35.	IC Tj	32.82 degC	Op_point	IC junction temperature
36.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
37.	IOUT_OP	2.0 A	Op_point	Iout operating point
38.	M1 TJOP	31.887 degC	Op_point	M1 MOSFET junction temperature
39.	Peak Rectified Vin	311.124 V	Op_point	Peak voltage seen at rectified input
40.	Vin_OP_RMS	220.0 V	Op_point	AC Input RMS Voltage
41.	Vout p-p	28.608 mV	Op_point	Peak-to-peak output ripple voltage
42.	Avg Bridge Diode Pd	60.646 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
43.	Cbulk Pd	65.004 mW	Power	Bulk capacitor power dissipation
44.	Cout1 Pd	29.017 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	330.58 mW	Power	Secondary Diode Power Dissipation
48.	Dsec2 Pd	330.58 mW	Power	Secondary Diode Power Dissipation
49.	IC Pd	56.395 mW	Power	IC power dissipation
50.	L1 Pd	166.838 μW	Power	Power Dissipation in the Inductor
51.	L2 Pd	9.6 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
52.	M1 Pd	30.199 mW	Power	M1 MOSFET total power dissipation
53.	Paux	17.977 mW	Power	Power Dissipation in Raux and Daux
54.	Pd Rstartup	375.534 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
55.	Rdrv Pd	24.167 μW	Power	Power Dissipation in Gate Drive Resistor
56.	Rfb Pd	4.371 mW	Power	Rfb Power Dissipation
57.	Rsns Pd	24.951 mW	Power	Current Limit Sense Resistor Power Dissipation
58.	Rx Pd	483.845 mW	Power	Total Power Dissipation in Rx1 and Rx2
59.	Snubber Pd	136.688 mW	Power	Snubber Power Dissipation
60.	T1 Pd	140.326 mW	Power	Estimated Losses in Transformer
61.	Total Pd	1.793 W	Power	Total Power Dissipation
62.	Vout Tolerance	1.478 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
63.	Vout pp percentage	572.152 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	230.0	Maximum input voltage
3.	VinMin	220.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	line_fsw	50.0	Light Output in Lumen
6.	base_pn	UCC38C43	Base Product Number
7.	source	AC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

1. **UCC38C43** Product Folder : <http://www.ti.com/product/UCC38C43> : contains the data sheet and other resources.

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