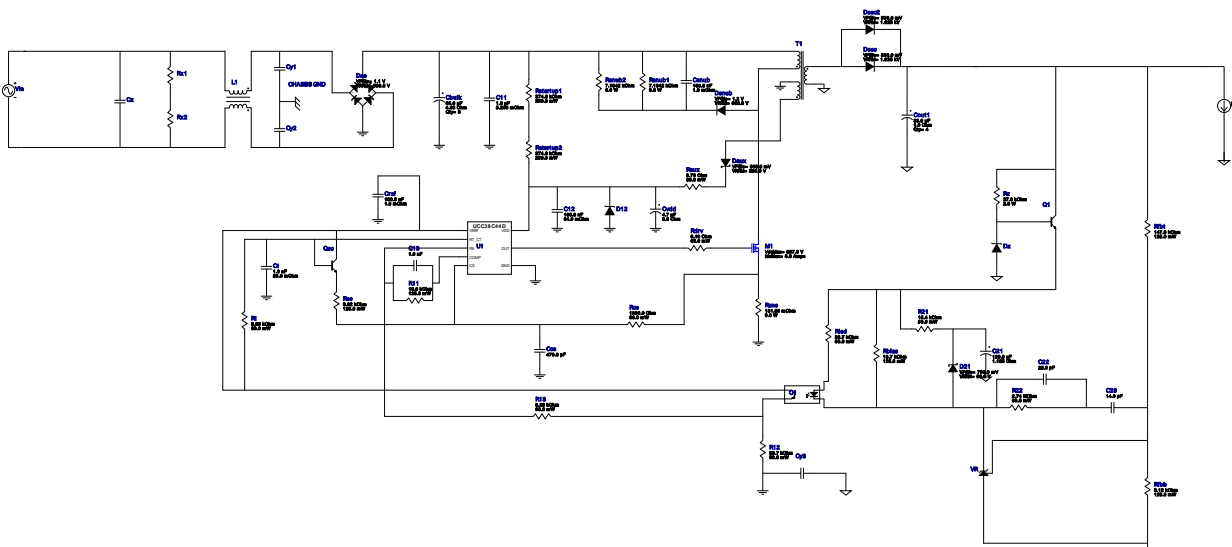


WEBENCH® Design Report

UCC38C44DR 130.0V-265.0V to 120.00V @ 1.0A




















1. The EMI filter shown in the schematic is a placeholder. It has not yet been designed for the application.

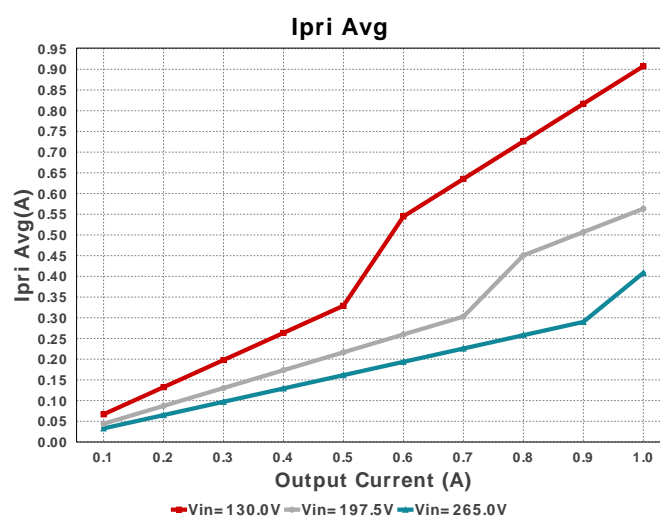
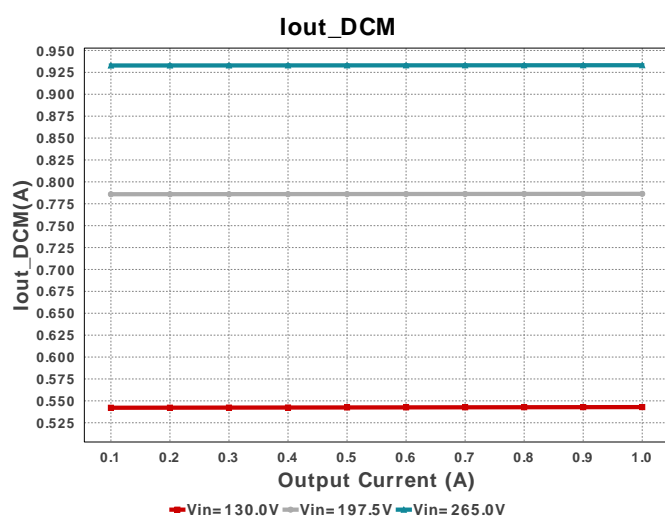
Electrical BOM

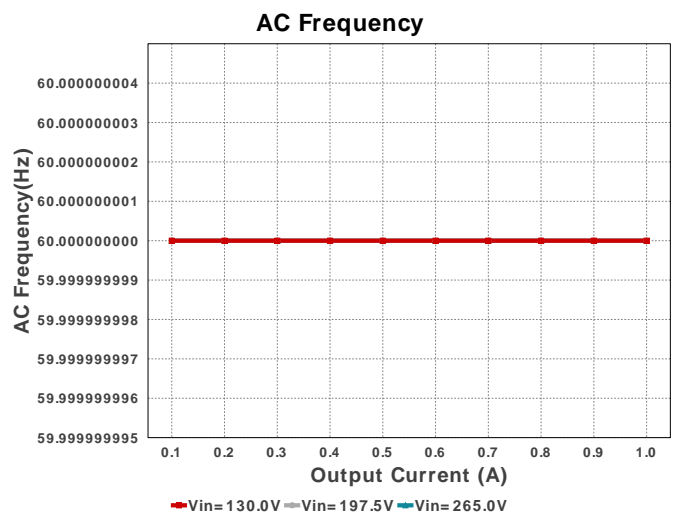
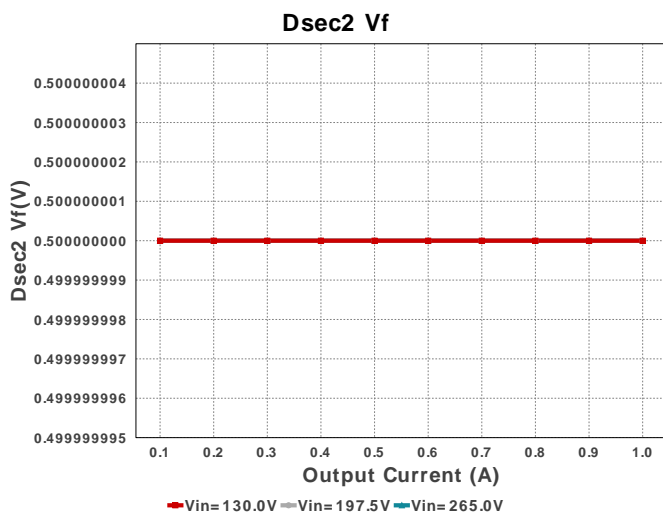
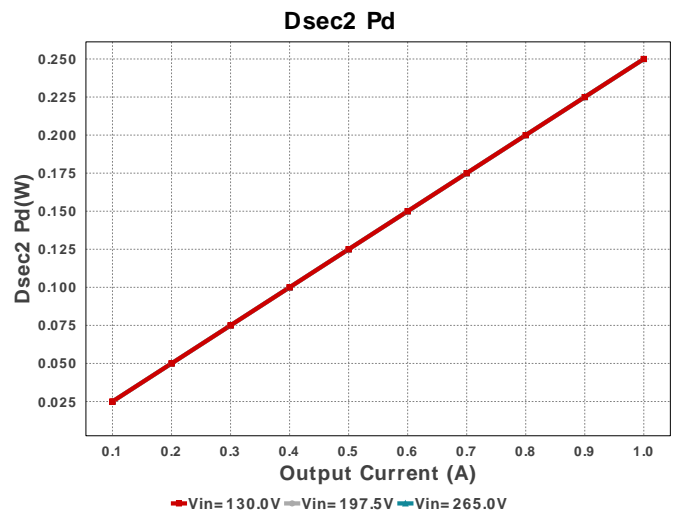
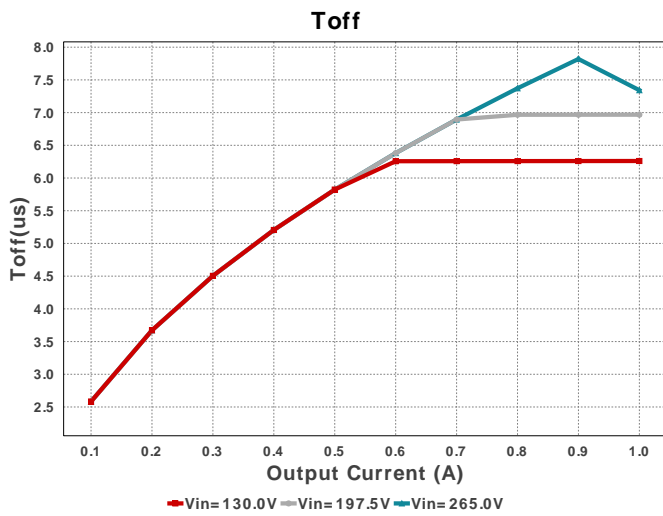
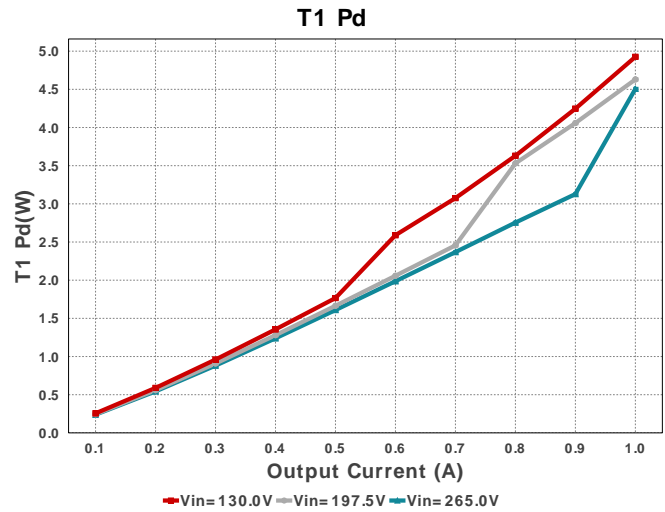
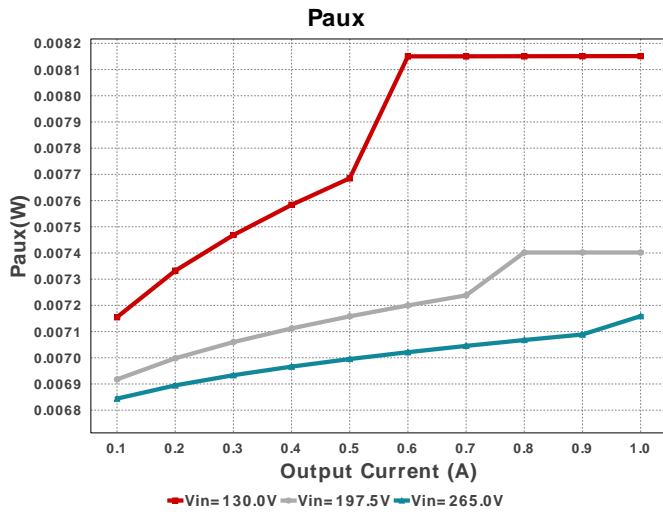
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1.	C11	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	\$1.70	 2220 54 mm ²
2.	C12	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	\$0.02	 0805 7 mm ²
3.	C13	Samsung Electro-Mechanics	CL05C102JB5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.02	 0402 3 mm ²
4.	C21	Chemi-Con	ELXZ500ELL121MH15D Series= LXZ	Cap= 120.0 uF ESR= 1.1051 Ohm VDC= 50.0 V IRMS= 635.0 mA	1	\$0.13	 Chemi-Con_800x1500 100 mm ²
5.	C22	Samsung Electro-Mechanics	CL21C220KBANNNC Series= C0G/NP0	Cap= 22.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
6.	C23	Samsung Electro-Mechanics	CL21C140JBANNNC Series= C0G/NP0	Cap= 14.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
7.	Cbulk	Chemi-Con	EKXG401ELL680MM25S Series= KXG	Cap= 68.0 uF ESR= 4.68 Ohm VDC= 400.0 V IRMS= 1.4625 A	3	\$0.97	 KXG_1800x2500 400 mm ²
8.	Ccs	MuRata	GRM1555C1H471JA01J Series= C0G/NP0	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²

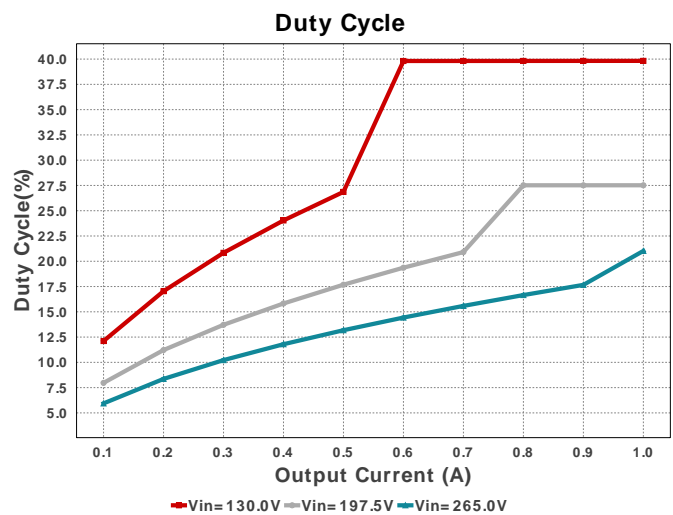
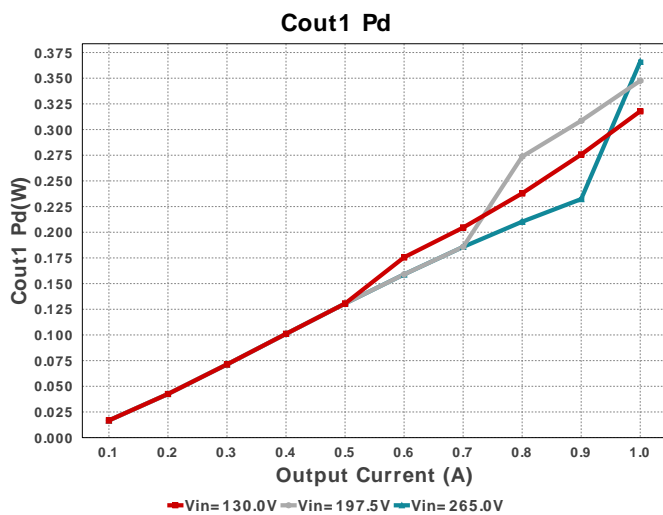
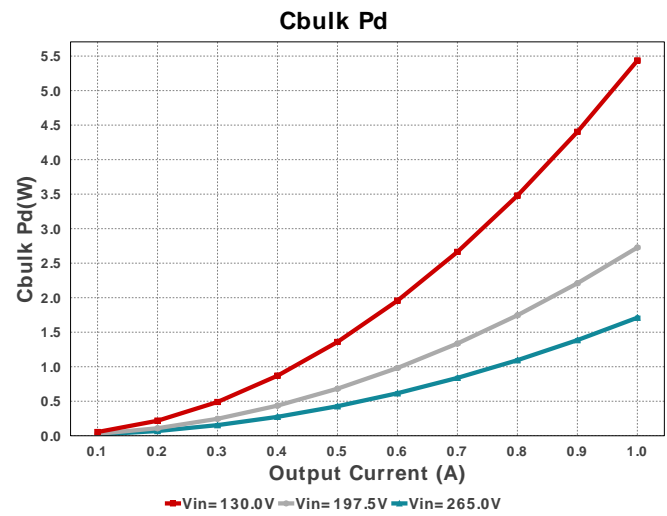
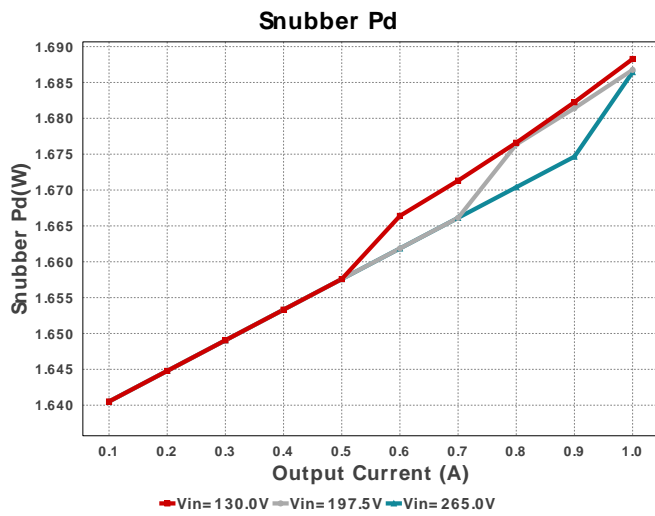
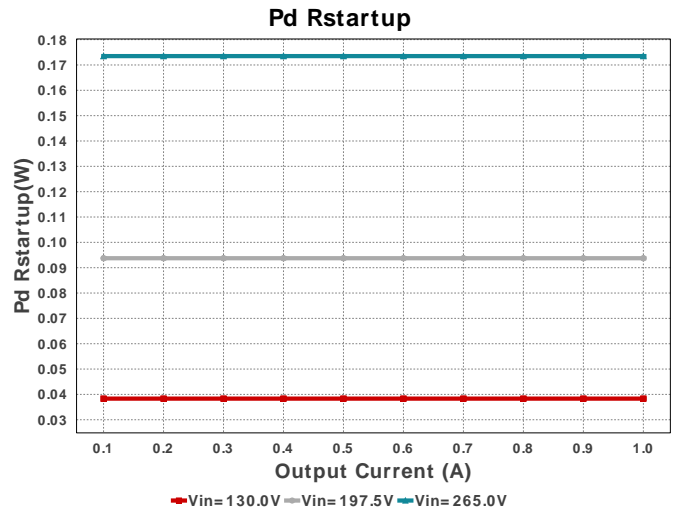
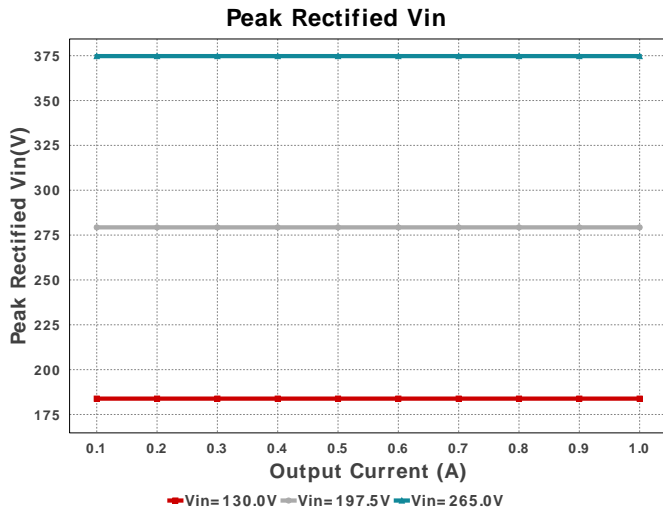
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9.	Cout1	Kemet	PEG124YJ2330QL1 Series= 2394	Cap= 33.0 uF ESR= 1.6 Ohm VDC= 450.0 V IRMS= 306.0 mA	4	\$4.12	 PEG124_2000x3700 1008 mm ²
10.	Cref	MuRata	GRM155R61C104KA88D Series= X5R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
11.	Csnub	TDK	C3216X7T2W104M160AA Series= X7T	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 450.0 V IRMS= 0.0 A	1	\$0.23	 1206_180 11 mm ²
12.	Ct	Kemet	C0805C102J5GACTU Series= C0G/NP0	Cap= 1.0 nF ESR= 25.0 mOhm VDC= 50.0 V IRMS= 1.71 A	1	\$0.02	 0805 7 mm ²
13.	Cvdd	Chemi-Con	EMVY350ADA4R7MD55G Series= MVY	Cap= 4.7 uF ESR= 3.0 Ohm VDC= 35.0 V IRMS= 60.0 mA	1	\$0.09	 CAPSMT_62_D55 28 mm ²
14.	D12	Diodes Inc.	MMSZ5248B-7-F	Zener	1	\$0.04	 SOD-123 13 mm ²
15.	D21	Fairchild Semiconductor	SS26FL	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.10	 SOD-123F 12 mm ²
16.	Dac	Diodes Inc.	DF1506S-T	VF@Io= 1.1 V VRRM= 600.0 V	1	\$0.23	 DF-S 99 mm ²
17.	Daux	SMC Diode Solutions	SK220ATR	VF@Io= 900.0 mV VRRM= 200.0 V	1	\$0.04	 SMA 37 mm ²
18.	Dsec	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 1.625 kV	1	NA	CUSTOM 0 mm ²
19.	Dsec2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 1.625 kV	1	NA	CUSTOM 0 mm ²
20.	Dsnub	Microsemi	UFS180JE3/TR13	VF@Io= 1.2 V VRRM= 800.0 V	1	\$0.71	 DO-214BA 42 mm ²
21.	Dz	Diodes Inc.	MMSZ5250B-7-F	Zener	1	\$0.04	 SOD-123 13 mm ²
22.	M1	NA	IdealFET	VdsMax= 597.0 V IdsMax= 5.0 Amps	1	NA	NA 0 mm ²
23.	O1	Fairchild Semiconductor	FOD817A	Optocoupler	1	\$0.13	 DIP-4 71 mm ²
24.	Q1	Nexperia	MMBTA42	Bipolar Transistor	1	\$0.05	 SOT-23 14 mm ²
25.	Qsc	STMicroelectronics	2N2222A	Bipolar Transistor	1	\$1.02	 TO-18 57 mm ²
26.	R11	Vishay-Dale	CRCW080510K0FKEA Series= CRCW..e3	Res= 10.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²

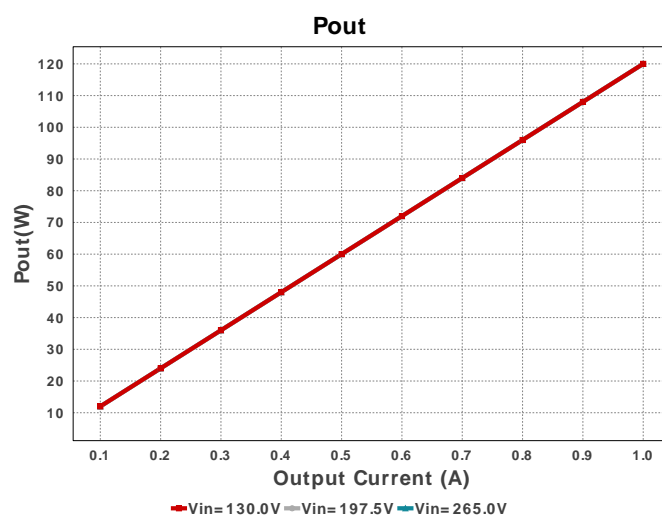
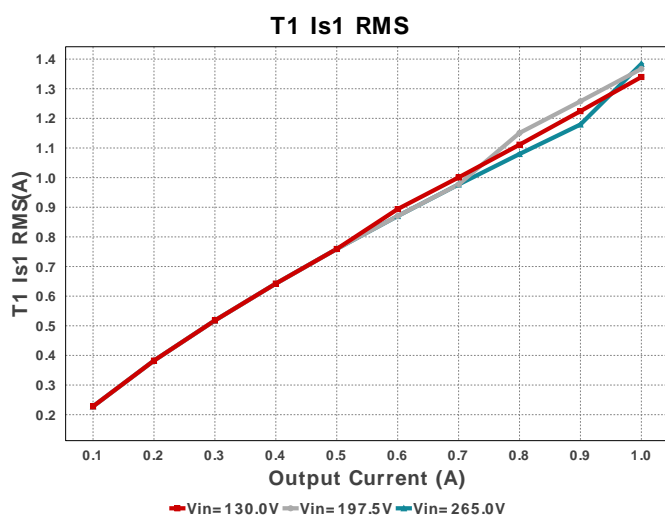
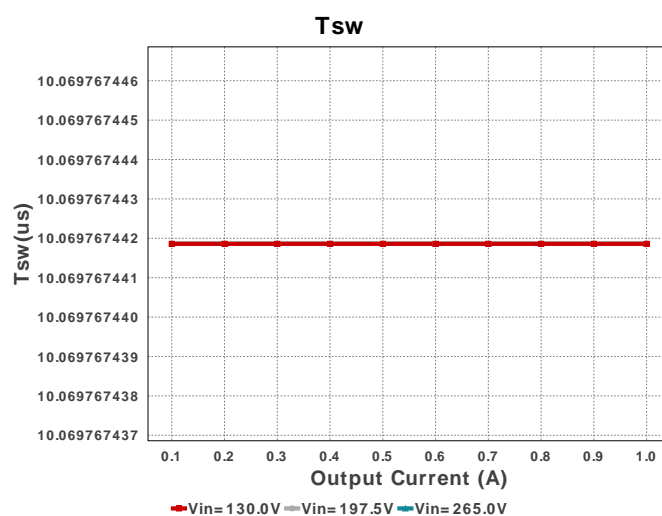
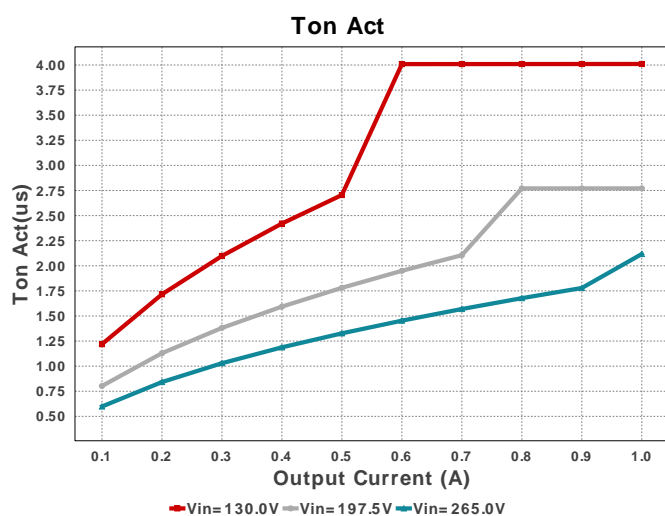
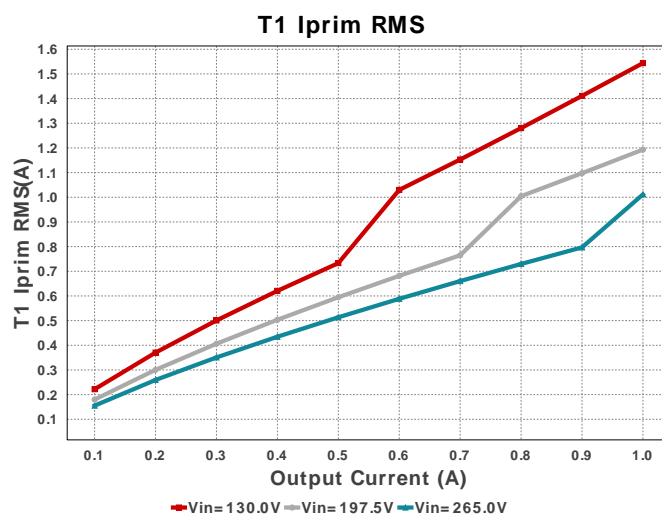
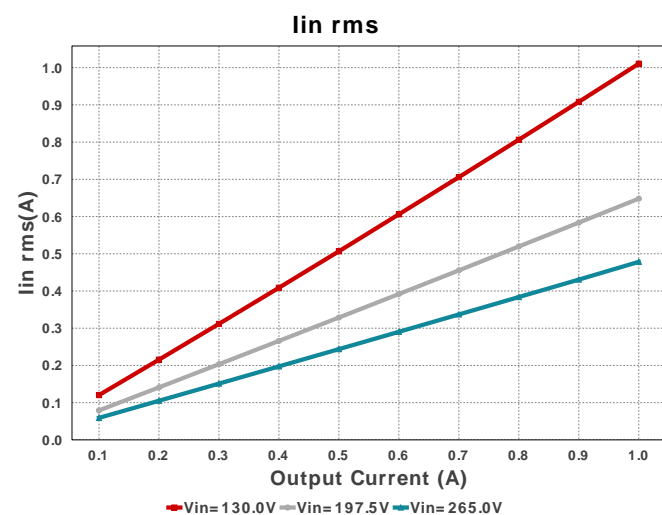
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	R12	Yageo	RC0201FR-0723K7L Series= ?	Res= 23.7 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	 0201 2 mm ²
28.	R13	Vishay-Dale	CRCW04025K23FKED Series= CRCW..e3	Res= 5.23 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
29.	R21	Yageo	RC0201FR-0715K4L Series= ?	Res= 15.4 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	 0201 2 mm ²
30.	R22	Vishay-Dale	CRCW04022M74FKED Series= CRCW..e3	Res= 2.74 MOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
31.	Raux	Vishay-Dale	CRCW04029R76FKED Series= CRCW..e3	Res= 9.76 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
32.	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
33.	Rcs	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
34.	Rdrv	Vishay-Dale	CRCW04026R19FKED Series= CRCW..e3	Res= 6.19 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
35.	Rfbb	Yageo	RT0805BRD073K12L Series= ?	Res= 3.12 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.05	 0805 7 mm ²
36.	Rfbt	Panasonic	ERJ-6ENF1473V Series= ERJ-6E	Res= 147.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
37.	Rled	Yageo	RC0201FR-0728K7L Series= ?	Res= 28.7 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	 0201 2 mm ²
38.	Rsc	Vishay-Dale	CRCW08053K92FKEA Series= CRCW..e3	Res= 3.92 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
39.	Rsns	CUSTOM	CUSTOM Series= ?	Res= 181.89 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm ²
40.	Rsnub1	CUSTOM	CUSTOM Series= ?	Res= 7.1042 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm ²
41.	Rsnub2	CUSTOM	CUSTOM Series= ?	Res= 7.1042 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm ²
42.	Rstartup1	Yageo	RC1206FR-07374KL Series= ?	Res= 374.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
43.	Rstartup2	Yageo	RC1206FR-07374KL Series= ?	Res= 374.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
44.	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
45.	Rz	Stackpole Electronics Inc	RSMF2JT27K0 Series= ?	Res= 27.0 kOhm Power= 2.0 W Tolerance= 5.0%	1	\$0.02	 RSMF2 148 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
46.	T1	Core=TDK , CoilFormer=TDK	Core=B66229G0000X187 , CoilFormer=B66230A1114T001	Lp= 203.0 μ H Turns Ratio(Nas)= 6:51 Turns Ratio(Nps)= 36:51 Npri= 36.0 Naux= 6.0 Naux= 51.0	1	\$1.34	 1313 mm ²
47.	U1	Texas Instruments	UCC38C44DR	Switcher	1	\$0.58	 D0008A 57 mm ²
48.	VR	Texas Instruments	TL431AIDBZR	Voltage References	1	\$0.08	 DBZ0003A 14 mm ²

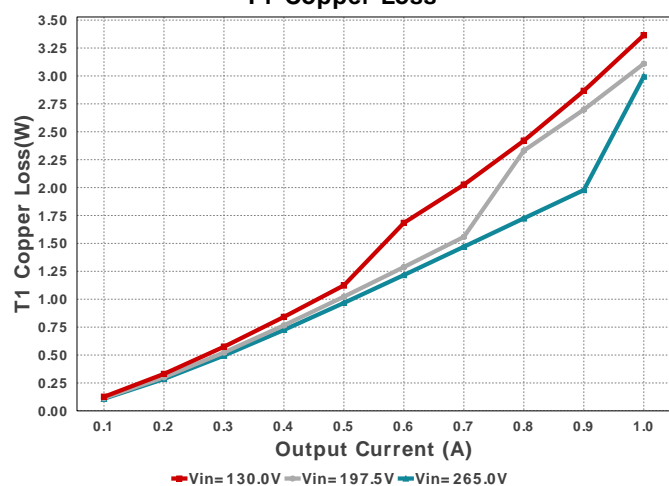




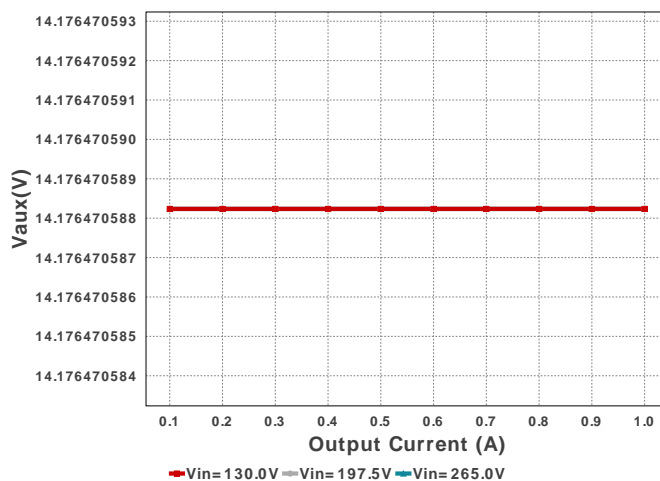




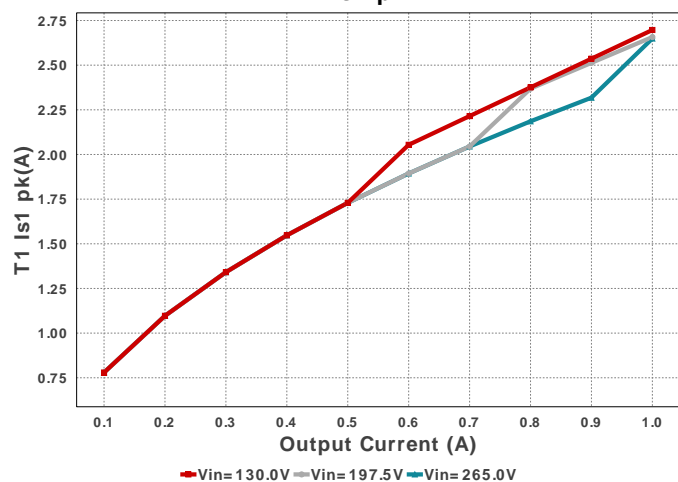
T1 Copper Loss



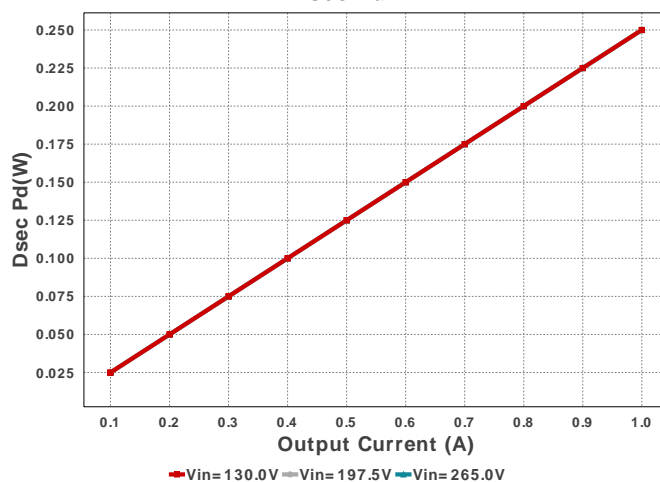
Vaux



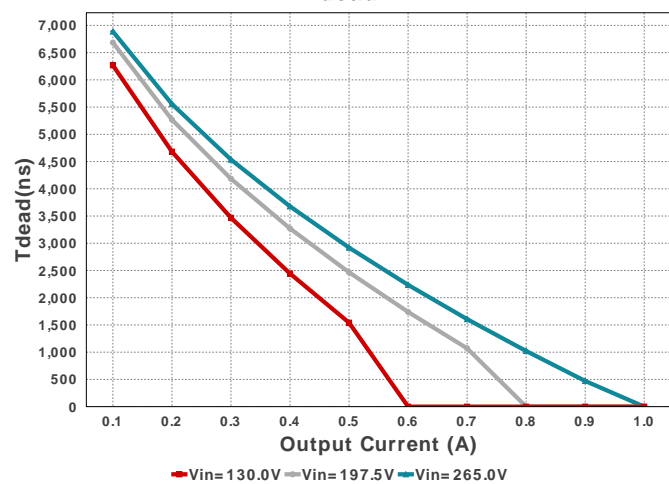
T1 Is1 pk



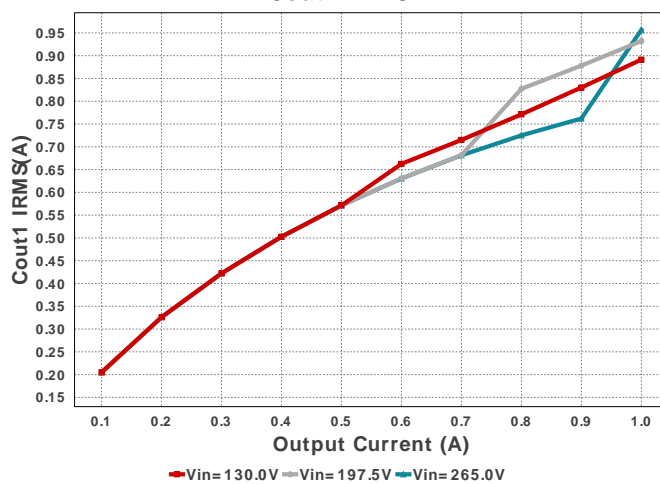
Dsec Pd

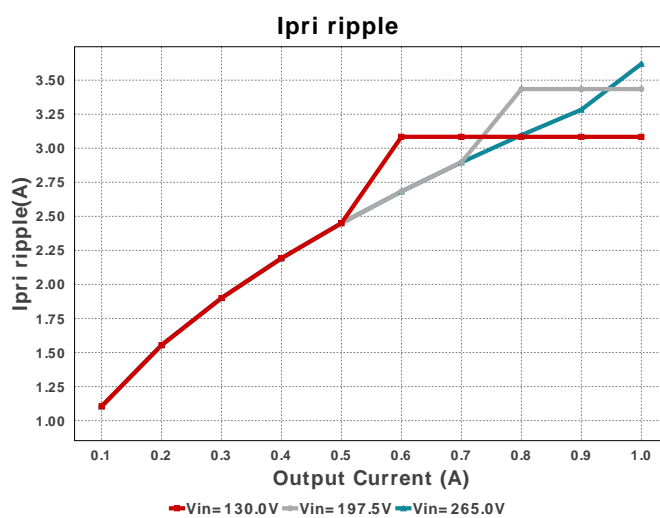
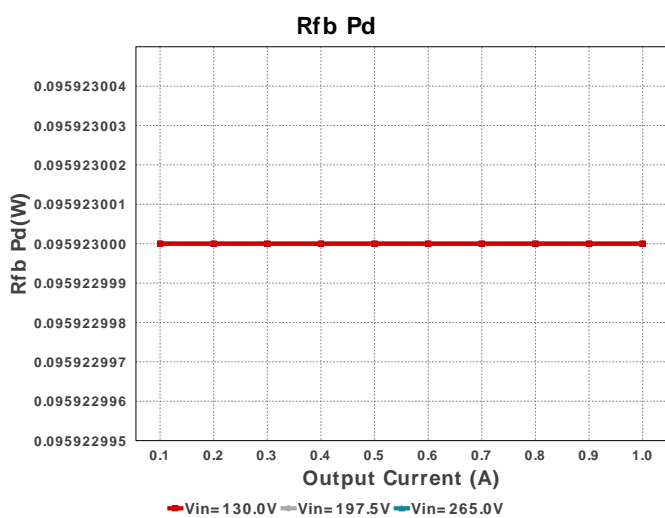
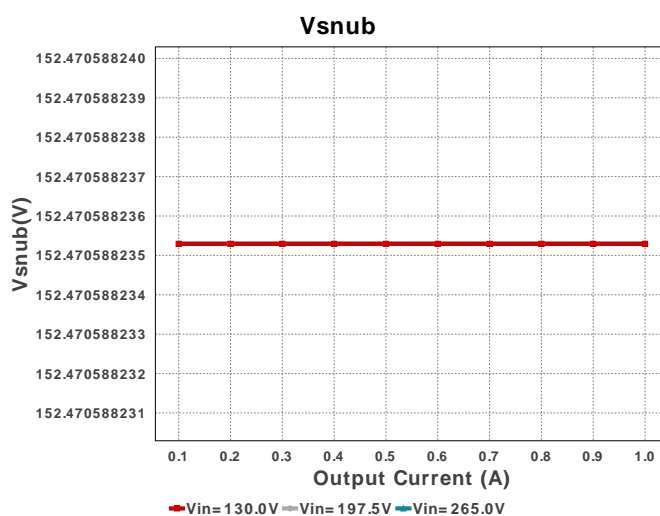
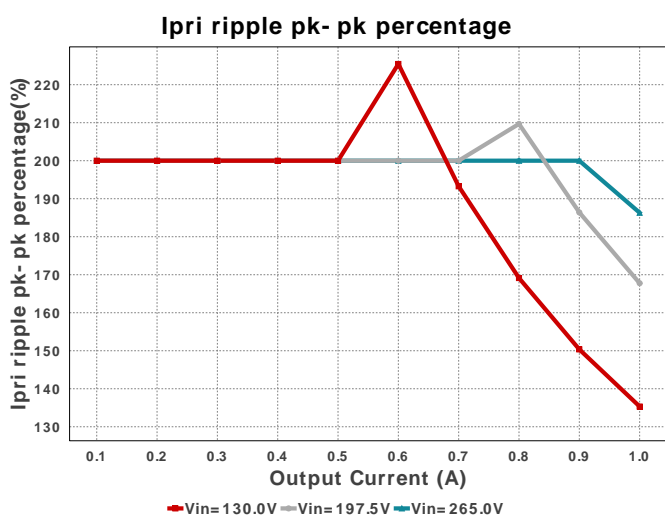
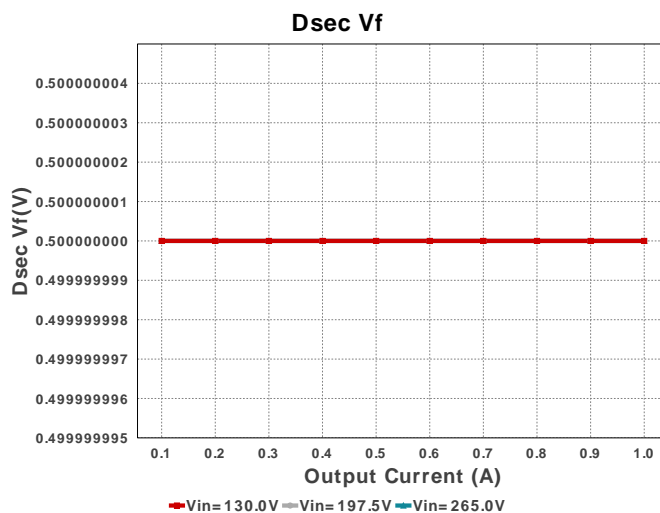
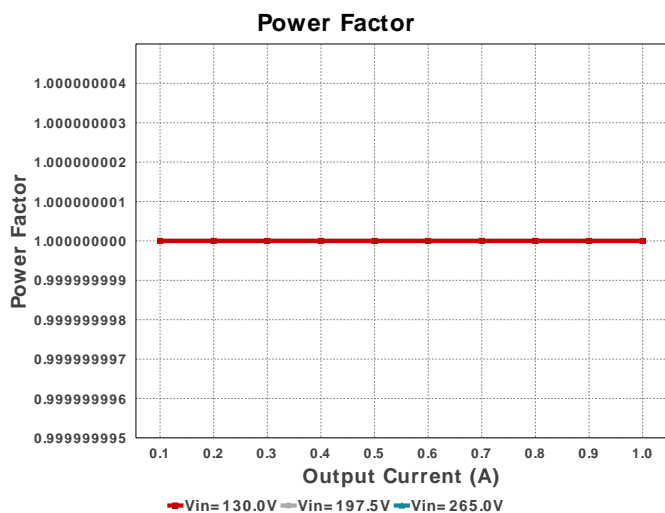


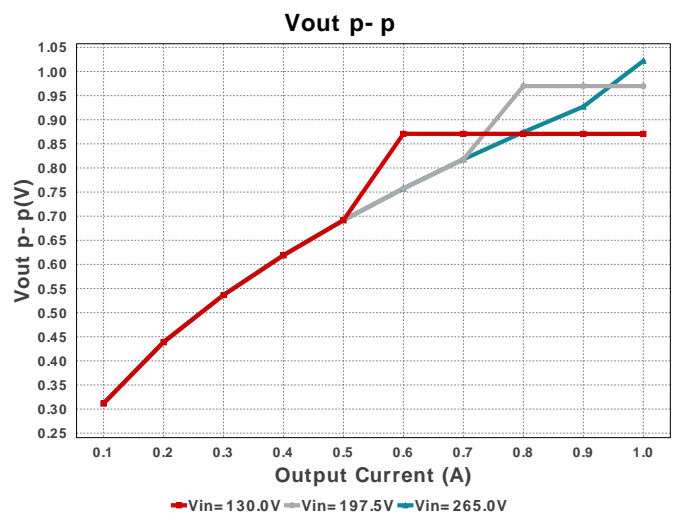
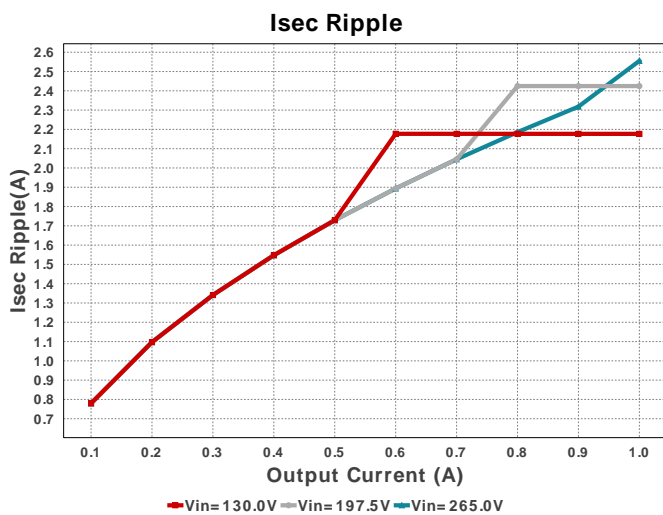
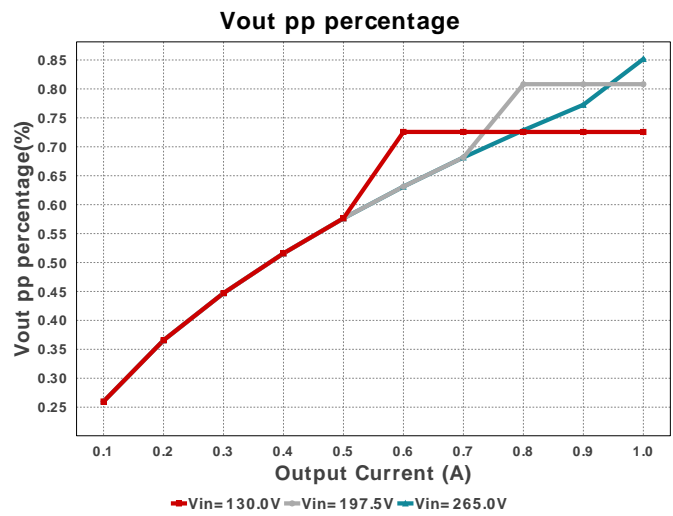
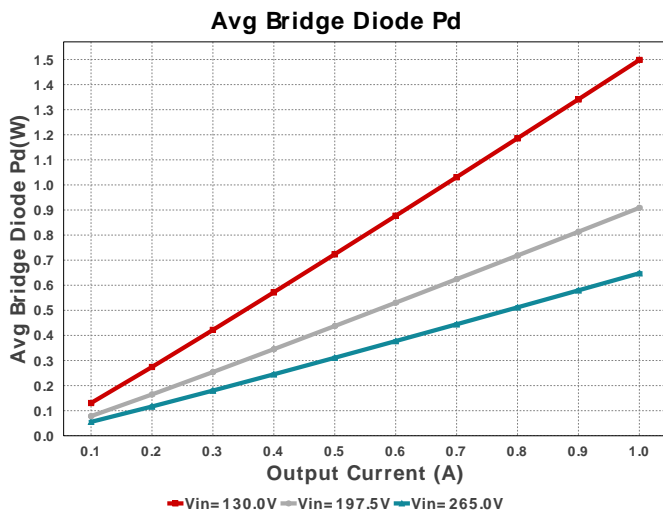
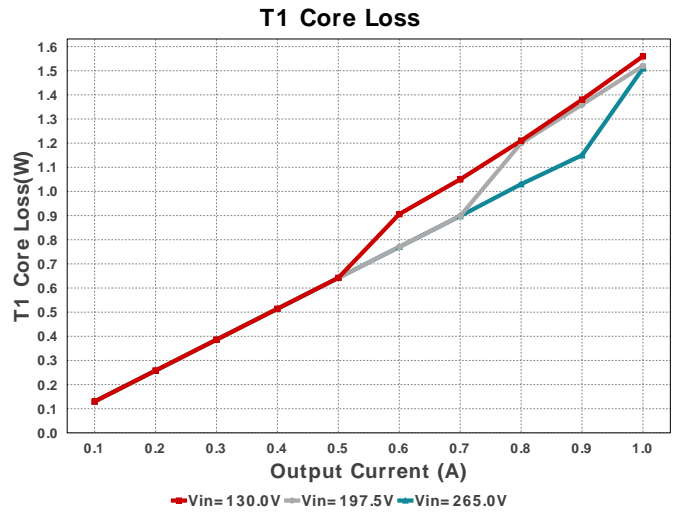
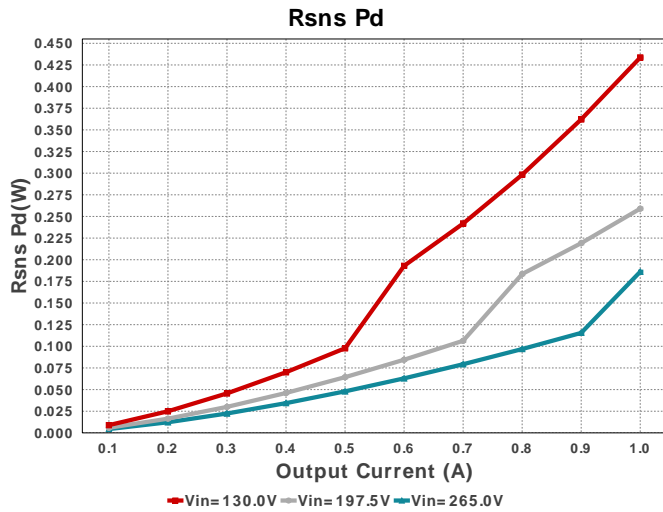
Tdead

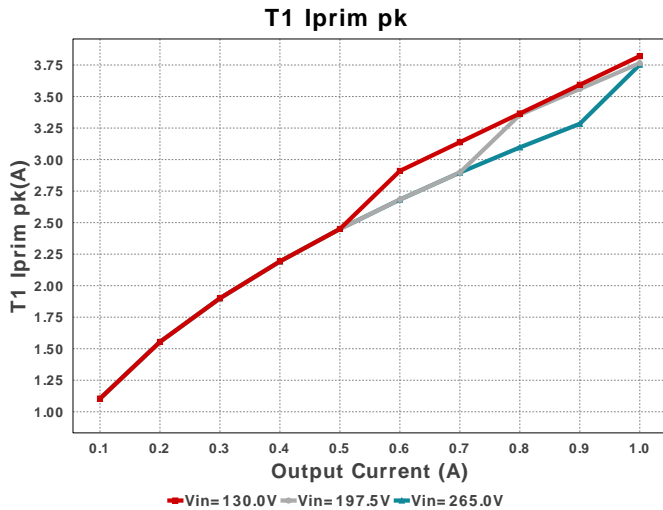


Cout1 IRMS









Operating Values

#	Name	Value	Category	Description
1.	Cbulk Pd	5.435 W	Capacitor	Bulk capacitor power dissipation
2.	Cout1 IRMS	891.415 mA	Capacitor	Output capacitor1 RMS ripple current
3.	Cout1 Pd	317.85 mW	Capacitor	Output capacitor1 power dissipation
4.	Avg Bridge Diode Pd	1.498 W	Diode	Average Power Dissipation in the Bridge Diode over the AC Line Period
5.	Daux trr	0.0 ns	Diode	Auxiliary Diode Reverse Recovery Time
6.	Dsec Pd	250.0 mW	Diode	Secondary Diode Power Dissipation
7.	Dsec Vf	500.0 mV	Diode	Effective Forward Voltage Drop at the Operating Current
8.	Dsec trr	0.0 ns	Diode	Output Diode Reverse Recovery Time
9.	Dsec2 Pd	250.0 mW	Diode	Secondary Diode Power Dissipation
10.	Dsec2 Vf	500.0 mV	Diode	Effective Forward Voltage Drop at the Operating Current
11.	Dsnub trr	60.0 ns	Diode	Snubber Diode Reverse Recovery Time
12.	ICThetaJA	50.0 degC/W	IC	IC junction-to-ambient thermal resistance
13.	Avg Bridge Diode Pd	1.498 W	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
14.	Cbulk Pd	5.435 W	Power	Bulk capacitor power dissipation
15.	Cout1 Pd	317.85 mW	Power	Output capacitor1 power dissipation
16.	Dsec Pd	250.0 mW	Power	Secondary Diode Power Dissipation
17.	Dsec2 Pd	250.0 mW	Power	Secondary Diode Power Dissipation
18.	Paux	8.151 mW	Power	Power Dissipation in Raux and Daux
19.	Pd Rstartup	38.334 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
20.	Rfb Pd	95.923 mW	Power	Rfb Power Dissipation
21.	Rsns Pd	433.55 mW	Power	Current Limit Sense Resistor Power Dissipation
22.	Snubber Pd	1.688 W	Power	Snubber Power Dissipation
23.	T1 Copper Loss	3.232 W	Power	Transformer Copper Loss Power Dissipation
24.	T1 Core Loss	1.56 W	Power	Transformer Core Loss Power Dissipation
25.	T1 Pd	4.792 W	Power	Estimated Losses in Transformer
26.	Pd Rstartup	38.334 mW	Resistor	Power Dissipation in Rstartup1 and Rstartup2
27.	Rfb Pd	95.923 mW	Resistor	Rfb Power Dissipation
28.	Rsns Pd	433.55 mW	Resistor	Current Limit Sense Resistor Power Dissipation
29.	AC Frequency	50.0 Hz	System	Input AC frequency
30.	BOM Count	53	Information	Total Design BOM count
31.	Duty Cycle	39.824 %	Information	Duty cycle
32.	FootPrint	7.554 k mm ²	System	Total Foot Print Area of BOM components
33.	Frequency	99.307 kHz	Information	Switching frequency
34.	Iin rms	1.015 A	System	RMS Input Current
35.	Iout	1.0 A	Information	Iout operating point
36.	Iout_DCM	542.888 mA	System	Approximate Current below which DCM mode of operation will begin
37.	Mode	CCM	Information	Conduction Mode
38.	Peak Rectified Vin	183.846 V	System	Peak voltage seen at rectified input
39.	Pout	120.0 W	Information	Total output power
40.	Power Factor	1.0	System	Assumed Power Factor for the Application

#	Name	Value	Category	Description
41.	Tdead	0.0 ns	System Information	Approximate Dead Time of the Regulator
42.	Toff	6.26 us	System Information	Approximate Converter Off Time
43.	Ton Act	4.01 us	System Information	Approximate Converter On Time
44.	Total BOM	NA	System Information	Total BOM Cost
45.	Tsw	10.07 us	System Information	Switching Time Period
46.	Vin_RMS	130.0 V	System Information	Vin operating point
47.	Vout	120.0 V	System Information	Operational Output Voltage
48.	Vout Actual	120.048 V	System Information	Vout Actual calculated based on selected voltage divider resistors
49.	Vout Tolerance	1.402 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
50.	Vout p-p	870.716 mV	System Information	Peak-to-peak output ripple voltage
51.	Vout pp percentage	725.597 m%	System Information	Output Voltage ripple percentage
52.	Vsnub	152.471 V	System Information	Voltage Across the Snubber
53.	Ipri Avg	907.503 mA	Transformer	Average Current in Primary Winding over the complete Switching Period
54.	Ipri ripple	3.084 A	Transformer	Ripple Current in the Primary Winding
55.	Ipri ripple pk-pk percentage	135.326 %	Transformer	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
56.	Isec Ripple	2.177 A	Transformer	Ripple Current in the Secondary Winding
57.	Paux	8.151 mW	Transformer	Power Dissipation in Raux and Daux
58.	T1 Copper Loss	3.232 W	Transformer	Transformer Copper Loss Power Dissipation
59.	T1 Core Loss	1.56 W	Transformer	Transformer Core Loss Power Dissipation
60.	T1 Iprim RMS	1.544 A	Transformer	Transformer Primary RMS Current
61.	T1 Iprim pk	3.821 A	Transformer	Transformer Primary Peak Current
62.	T1 Is1 RMS	1.34 A	Transformer	Transformer Secondary1 RMS Current
63.	T1 Is1 pk	2.697 A	Transformer	Transformer Secondary1 Peak Current
64.	T1 Pd	4.792 W	Transformer	Estimated Losses in Transformer
65.	Vaux	14.176 V	Transformer	Auxiliary Voltage

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	VinMax	265.0	Maximum input voltage
3.	VinMin	130.0	Minimum input voltage
4.	Vout	120.0	Output Voltage
5.	acFrequency	50.0	AC Frequency
6.	base_pn	UCC38C44	Base Product Number
7.	source	AC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

1. **UCC38C44** Product Folder : <http://www.ti.com/product/UCC38C44> : contains the data sheet and other resources.

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