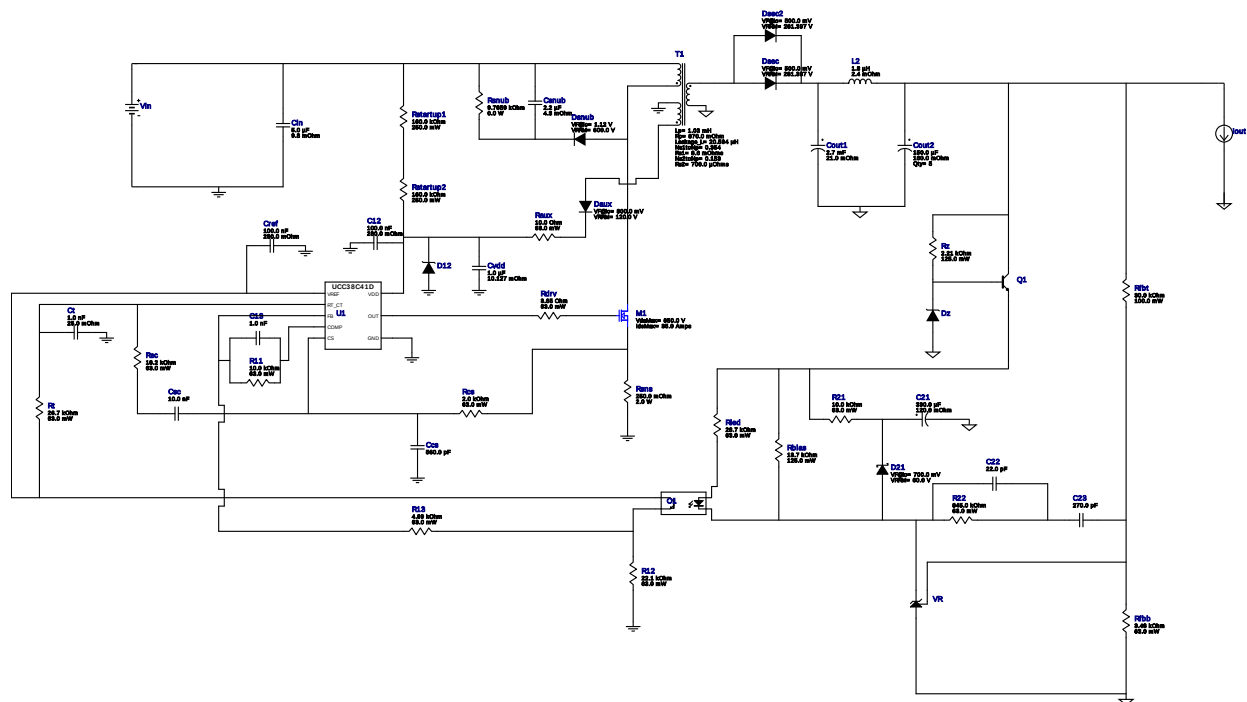
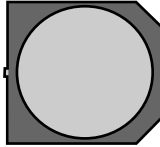


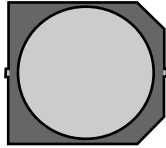
WEBENCH® Design Report

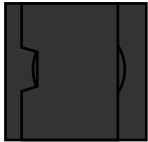
Design : 3496425/84 UCC38C41DR
UCC38C41DR 110.0V-250.0V to 24.00V @ 3.0A



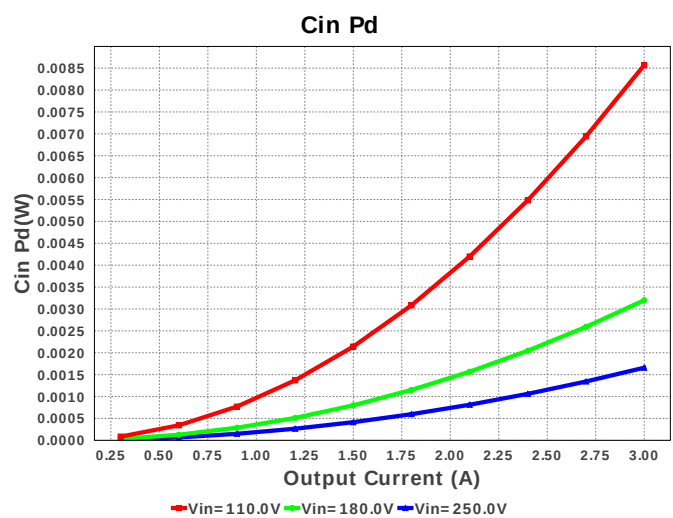
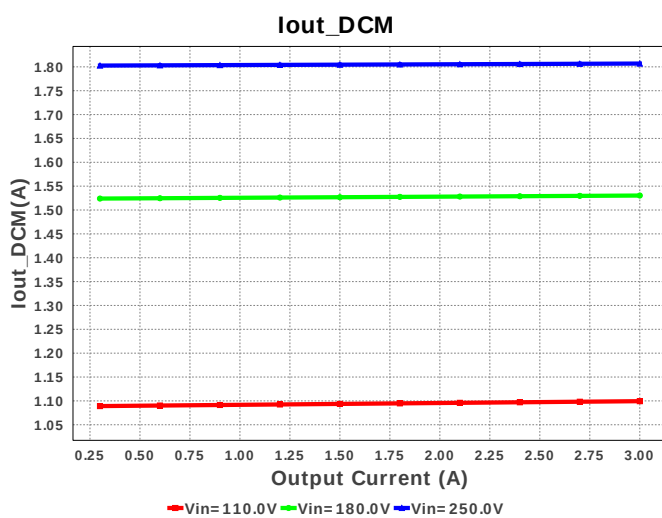
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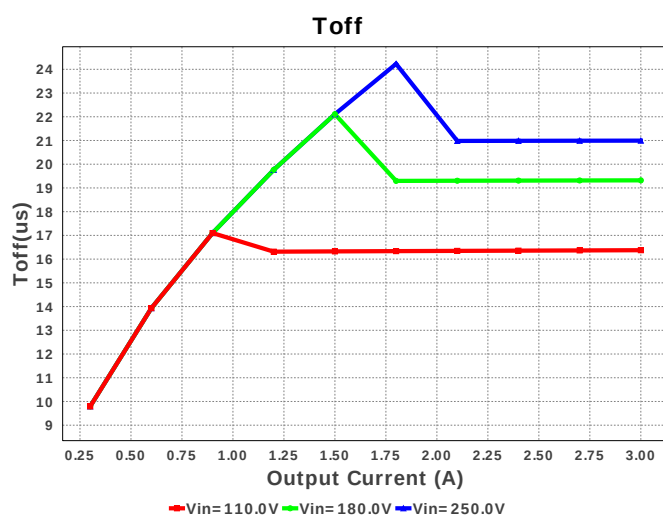
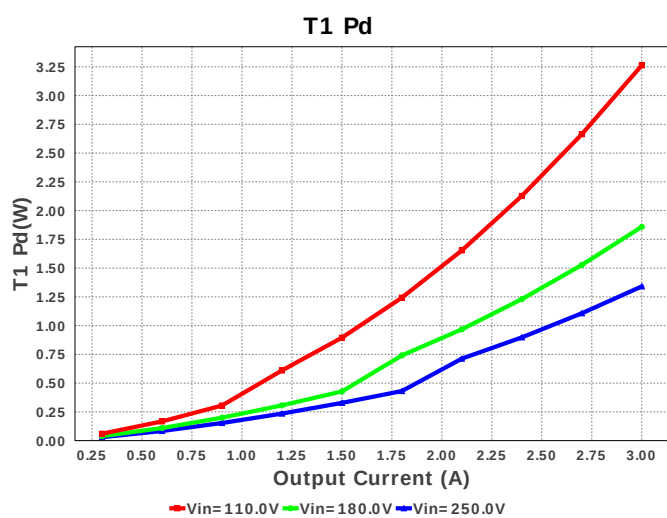
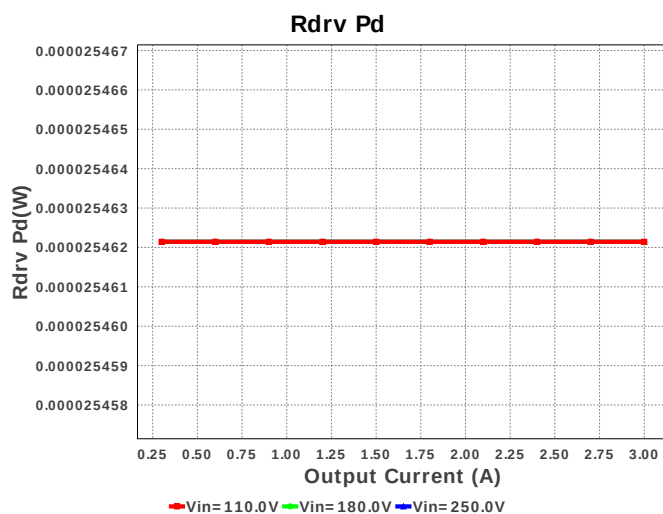
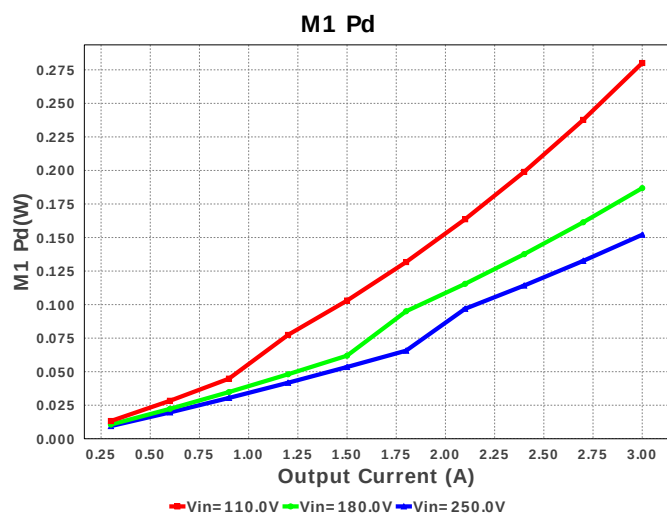
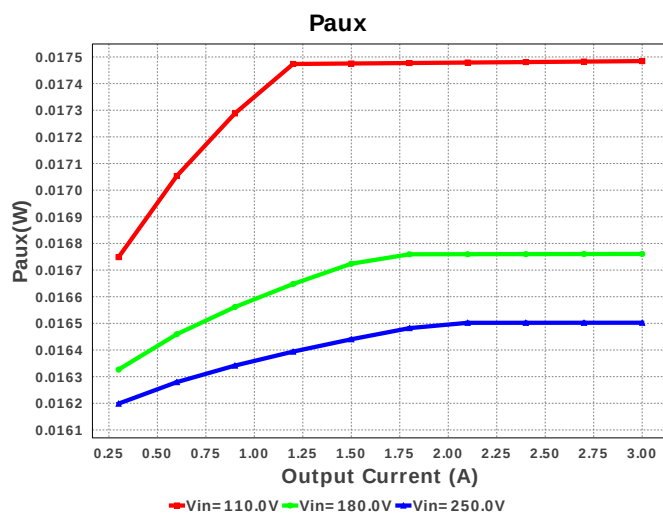
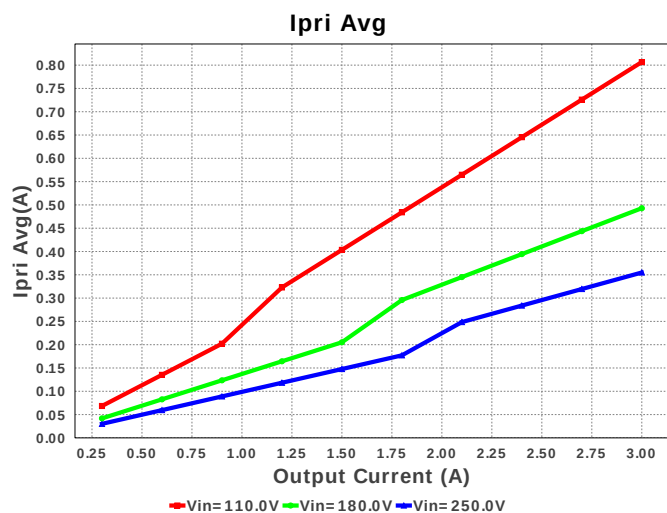
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	C13	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	C21	Panasonic	EEV-FK1H331Q Series= FK	Cap= 330.0 uF ESR= 120.0 mOhm VDC= 50.0 V IRMS= 900.0 mA	1	\$0.48	 SM_RADIAL_H13 264 mm ²
4.	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
5.	C23	Yageo America	CC0805KRX7R9BB271 Series= X7R	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Ccs	Yageo America	CC0805KRX7R9BB561 Series= X7R	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²

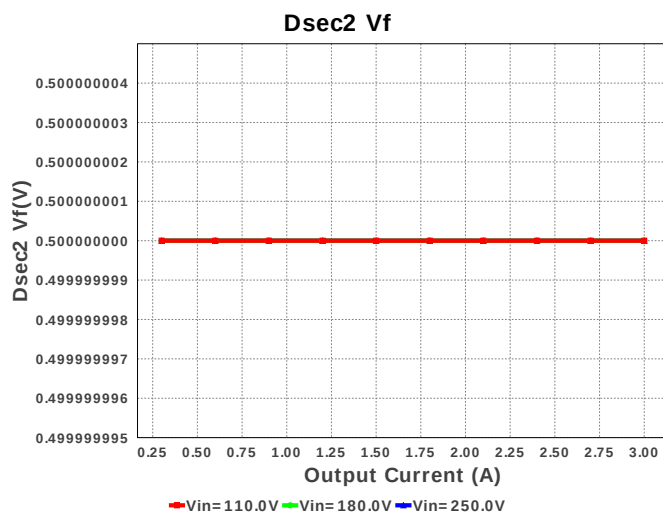
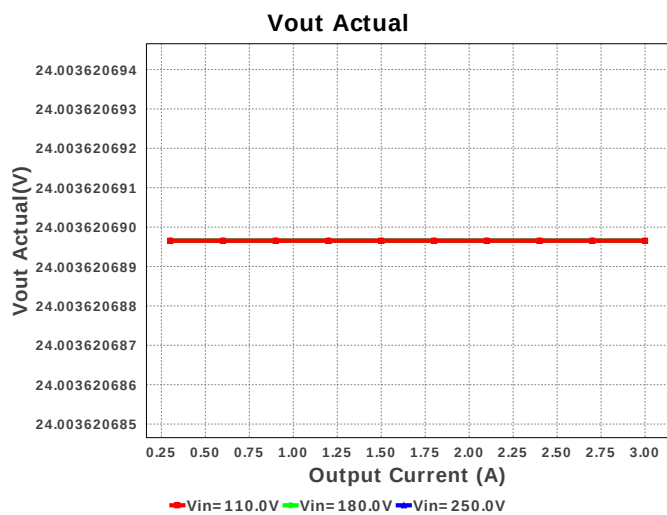
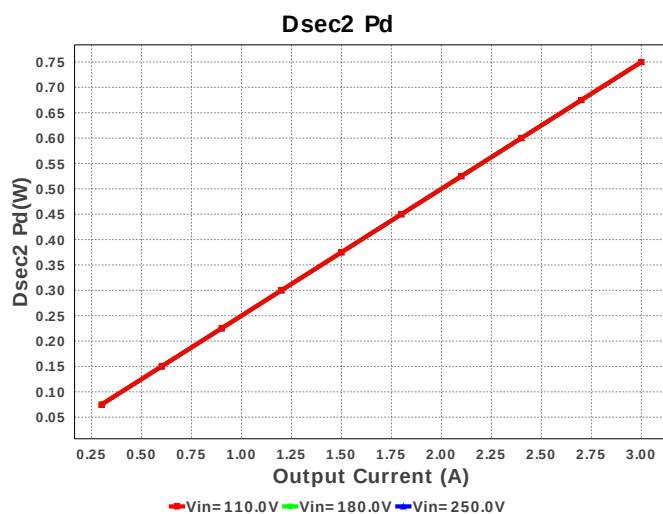
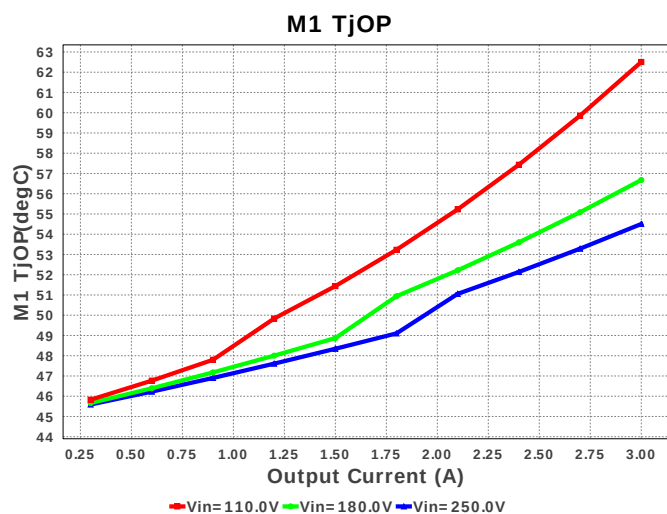
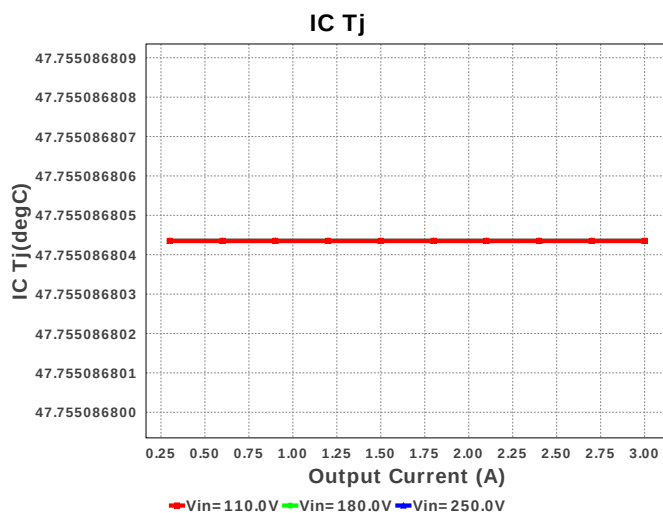
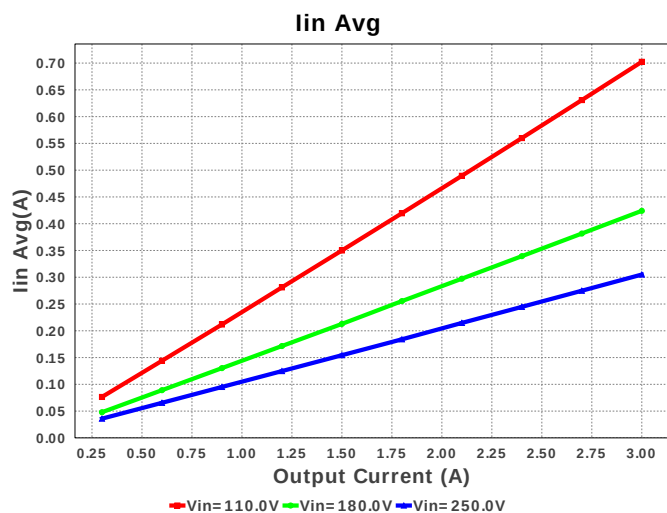
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7.	Cin	TDK	B32774D1505K Series= B32774	Cap= 5.0 uF ESR= 9.8 mOhm VDC= 1.3 kV IRMS= 10.5 A	1	\$3.08	 B32774_3150x2200x3650 804 mm ²
8.	Cout1	TDK	B41605A8278M009 Series= 2385	Cap= 2.7 mF ESR= 21.0 mOhm VDC= 63.0 V IRMS= 5.3 A	1	\$12.37	B41605_2500x4000_9 729 mm ²
9.	Cout2	Panasonic	EEV-FK1J151Q Series= FK	Cap= 150.0 uF ESR= 160.0 mOhm VDC= 63.0 V IRMS= 800.0 mA	5	\$0.51	 SM_RADIAL_H13 264 mm ²
10.	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
11.	Csc	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
12.	Csnub	TDK	C5750X6S2W225K Series= X6S	Cap= 2.2 uF ESR= 4.3 mOhm VDC= 400.0 V IRMS= 0.0 A	1	NA	 2220 54 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.	Cvdd	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	\$0.01	 0603 5 mm ²
15.	D12	Diodes Inc.	MMSZ5248B-7-F	Zener	1	\$0.04	 SOD-123 13 mm ²
16.	D21	Diodes Inc.	B260A-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.09	 SMA 37 mm ²
17.	Daux	Fairchild Semiconductor	FSV10120V	VF@Io= 800.0 mV VRRM= 120.0 V	1	\$0.21	 TO-277A 56 mm ²
18.	Dsec	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 281.397 V	1	NA	CUSTOM 0 mm ²
19.	Dsec2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 281.397 V	1	NA	CUSTOM 0 mm ²
20.	Dsnub	Bourns	CD214C-F3600	VF@Io= 1.12 V VRRM= 600.0 V	1	\$0.18	 SMC 83 mm ²
21.	Dz	Diodes Inc.	MMSZ5250B-7-F	Zener	1	\$0.03	 SOD-123 13 mm ²

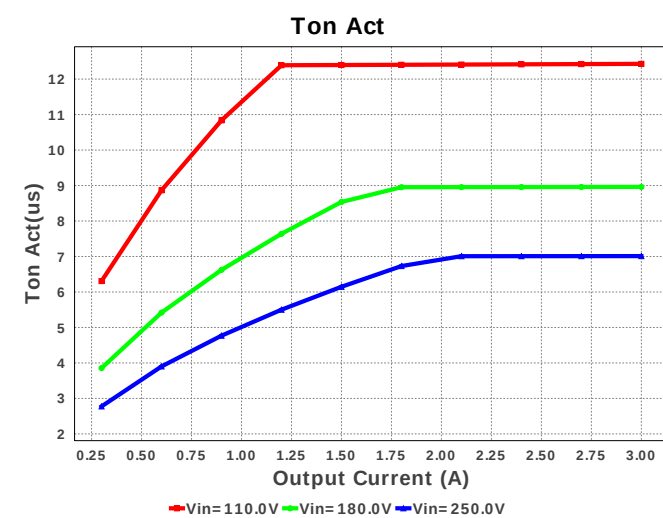
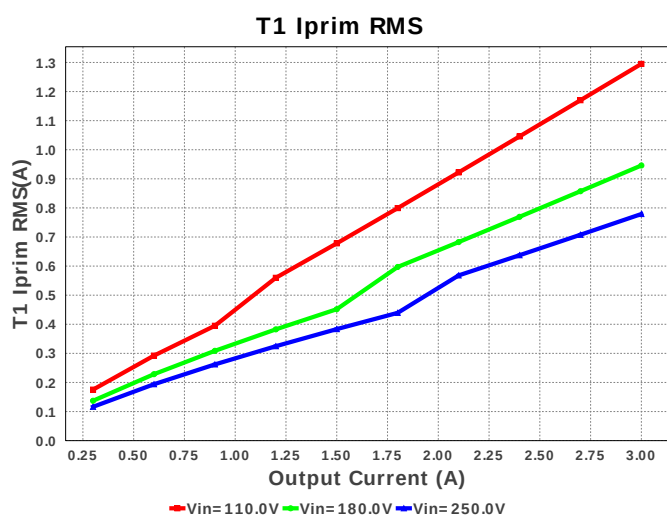
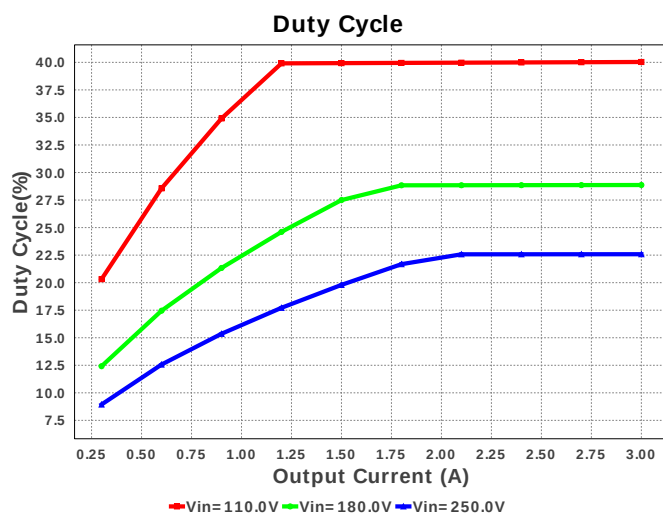
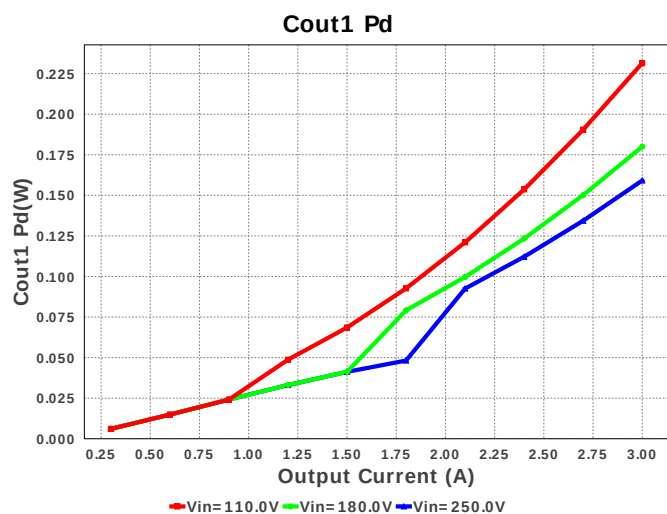
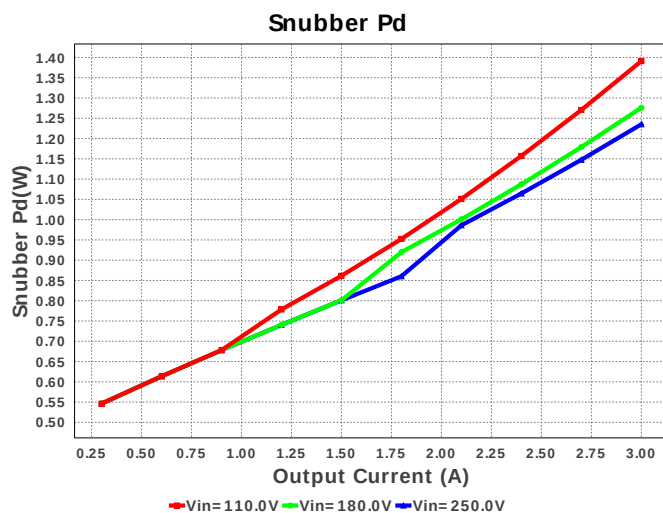
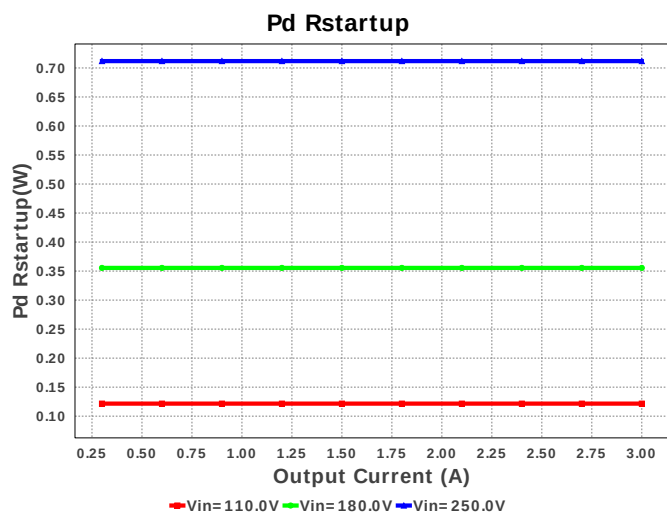
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
22.	L2	Coilcraft	SER1360-182KLB	L= 1.8 μ H DCR= 2.4 mOhm	1	\$0.72	 SER1360 225 mm ²
23.	M1	STMicroelectronics	STP45N65M5	VdsMax= 650.0 V IdsMax= 35.0 Amps	1	\$3.85	 TO-220AB 397 mm ²
24.	O1	Vishay-Semiconductor	TCMT1107	Optocoupler	1	\$0.21	 SOP-4 44 mm ²
25.	Q1	ON Semiconductor	BC846BLT1G	Bipolar Transistor	1	\$0.02	 SOT-23 14 mm ²
26.	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
27.	R12	Vishay-Dale	CRCW040222K1FKED Series= CRCW..e3	Res= 22.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
28.	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
29.	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
30.	R22	Vishay-Dale	CRCW0402845KFKED Series= CRCW..e3	Res= 845.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
31.	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
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	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
34.	Rdrv	Vishay-Dale	CRCW04023R65FKED Series= CRCW..e3	Res= 3.65 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
35.	Rfbb	Vishay-Dale	CRCW04023K48FKED Series= CRCW..e3	Res= 3.48 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
36.	Rfbt	Yageo America	RC0603FR-0730KL Series= ?	Res= 30.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
37.	Rled	Vishay-Dale	CRCW040228K7FKED Series= CRCW..e3	Res= 28.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
38.	Rsc	Vishay-Dale	CRCW040218K2FKED Series= CRCW..e3	Res= 18.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
39.	Rsns	Stackpole Electronics Inc	CSRN2512FKR250 Series= ?	Res= 250.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	\$0.13	 2512 43 mm ²
40.	Rsnub	CUSTOM	CUSTOM Series= ?	Res= 9.7859 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm ²

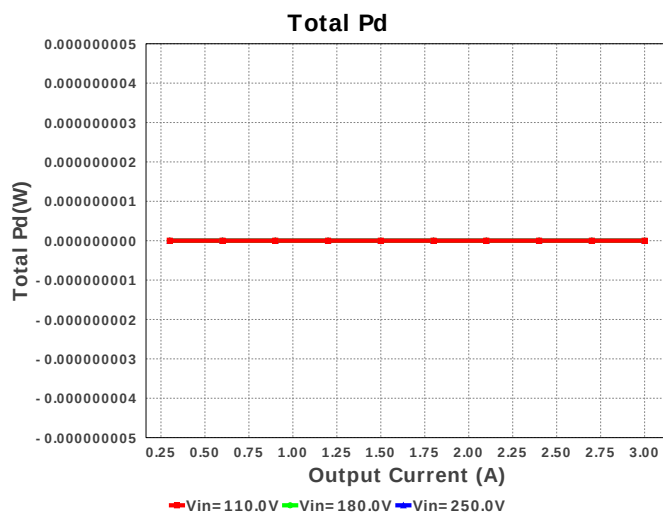
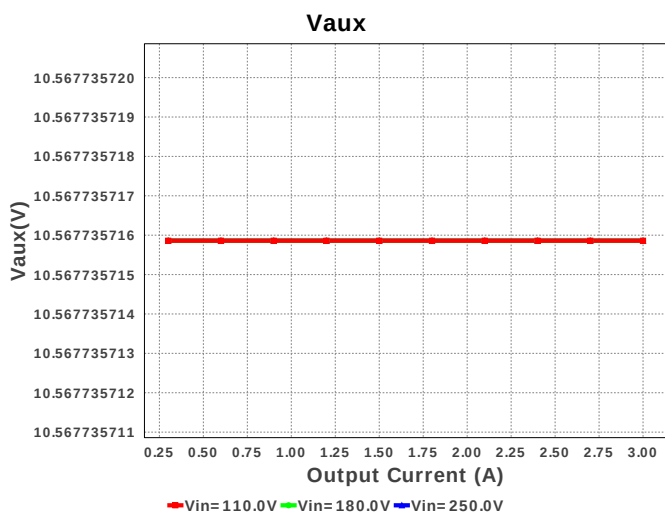
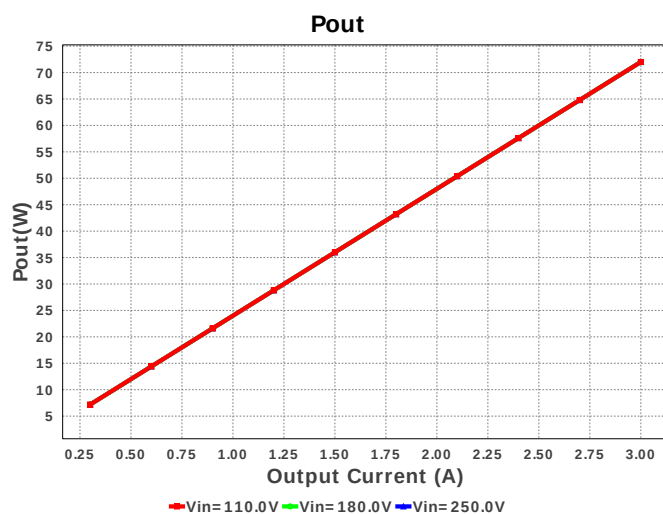
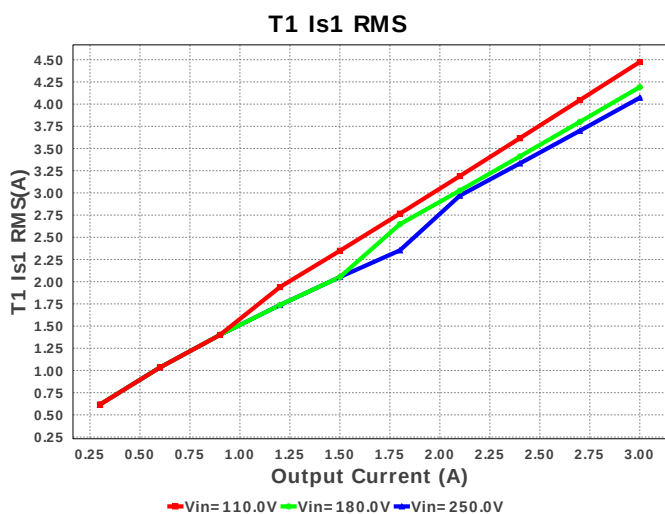
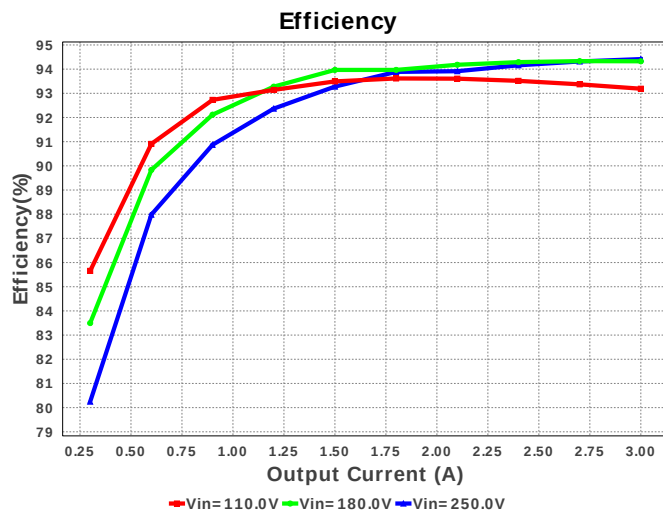
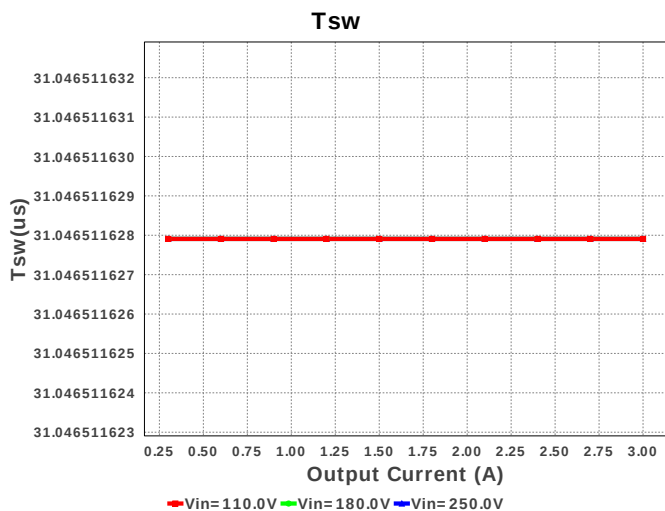
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
41.	Rstartup1	Yageo America	RC1206FR-07160KL Series= ?	Res= 160.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
42.	Rstartup2	Yageo America	RC1206FR-07160KL Series= ?	Res= 160.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
43.	Rt	Vishay-Dale	CRCW040226K7FKED Series= CRCW..e3	Res= 26.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
44.	Rz	Panasonic	ERJ-6ENF2211V Series= ERJ-6E	Res= 2.21 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
45.	T1	CUSTOM	CUSTOM	Lp= 1.03 mH Rp= 870.0 mOhm Leakage_L= 20.594 μ H Ns1toNp= 0.354 Rs1= 8.6 mOhms Ns2toNp= 0.153 Rs2= 700.0 μ Ohms	1	NA	CUSTOM 0 mm ²
46.	U1	Texas Instruments	UCC38C41DR	Switcher	1	\$0.70	 D0008A 57 mm ²
47.	VR	Texas Instruments	TL431AIDBVR	Voltage References	1	\$0.07	 R-PDSO-G3 16 mm ²

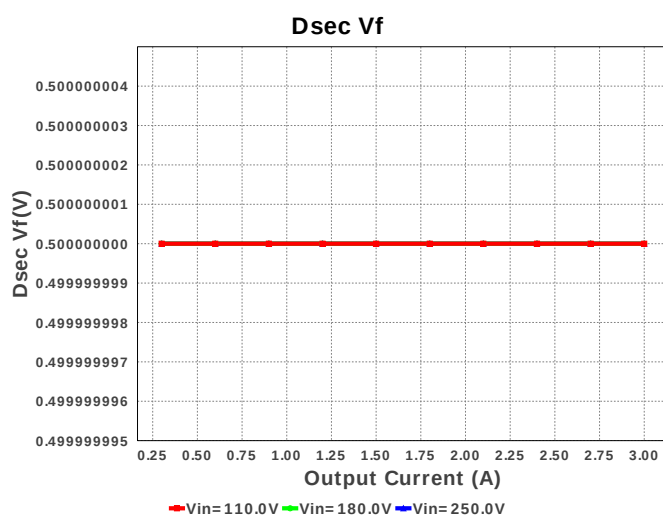
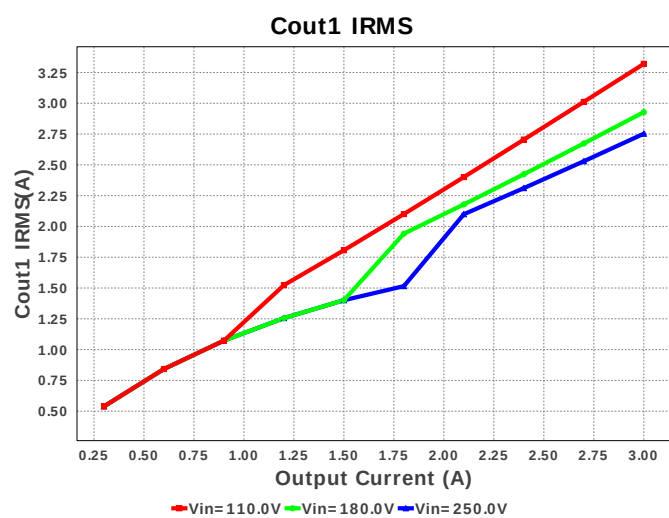
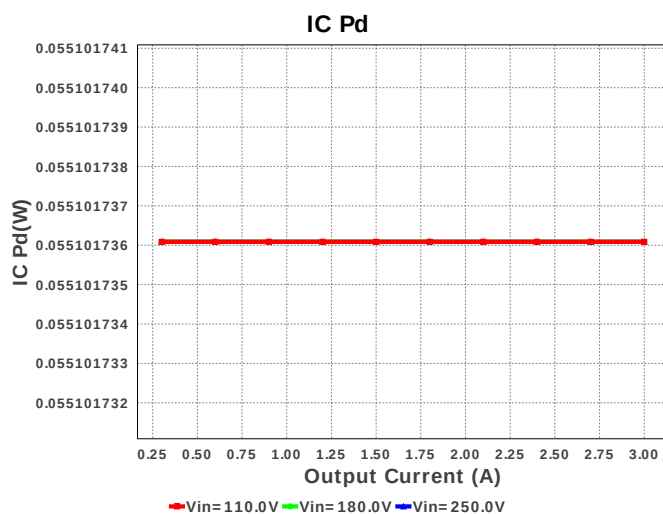
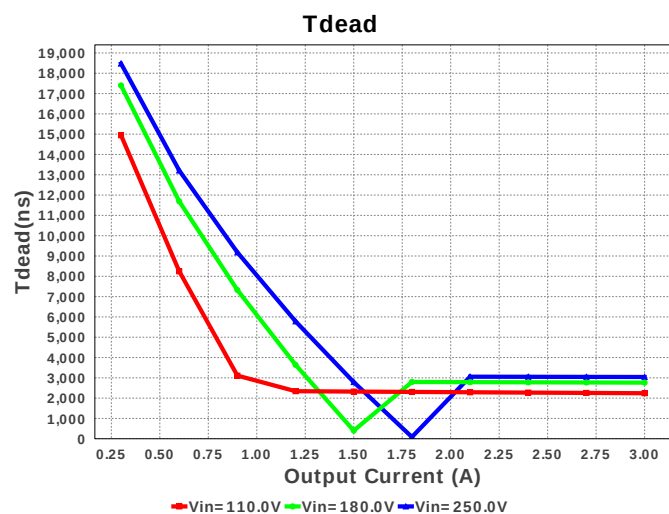
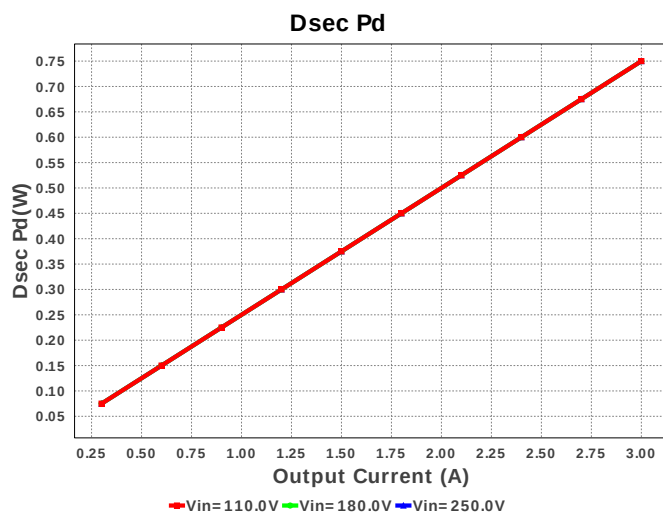
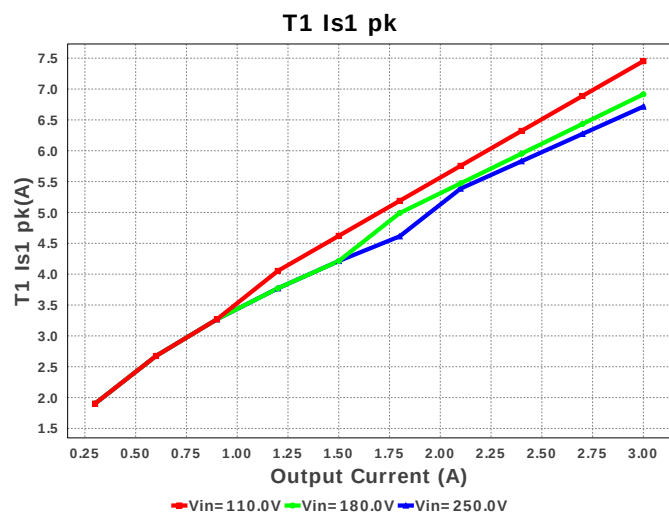


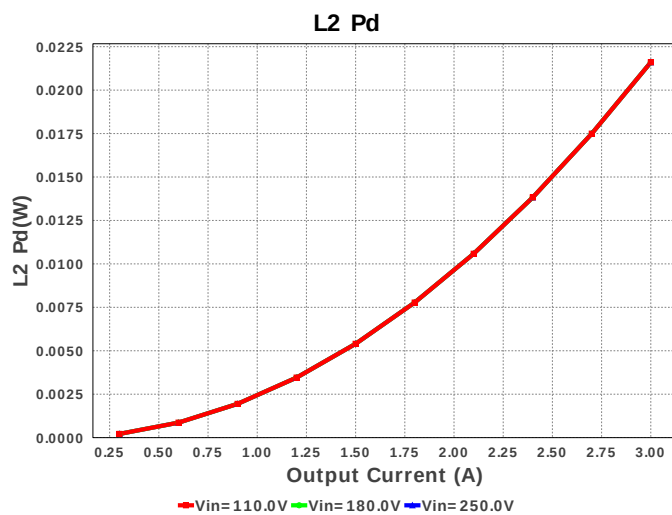
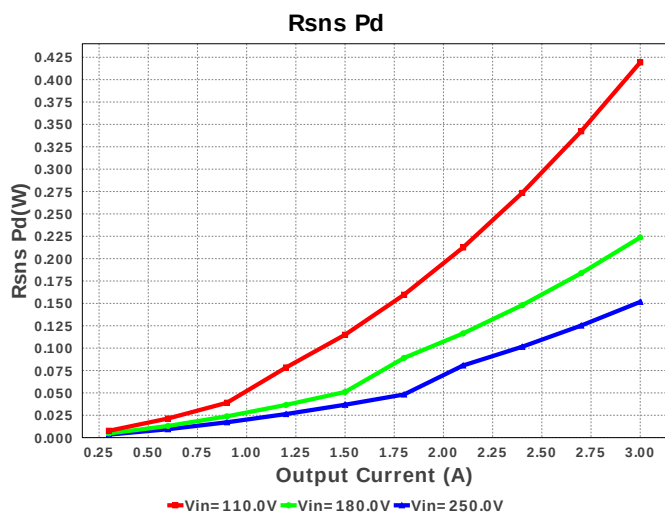
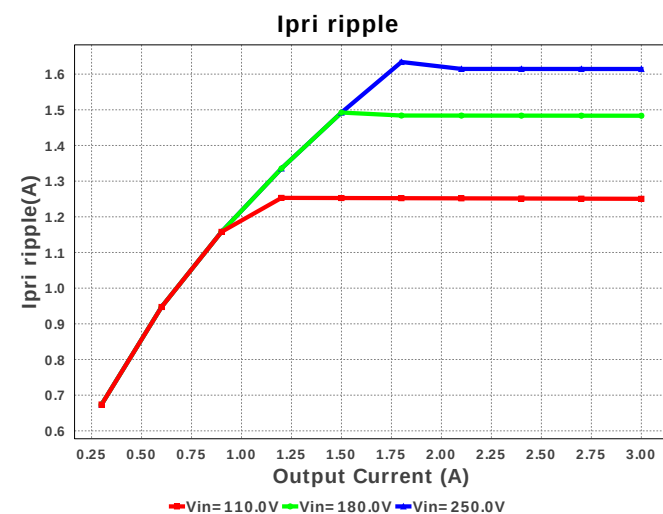
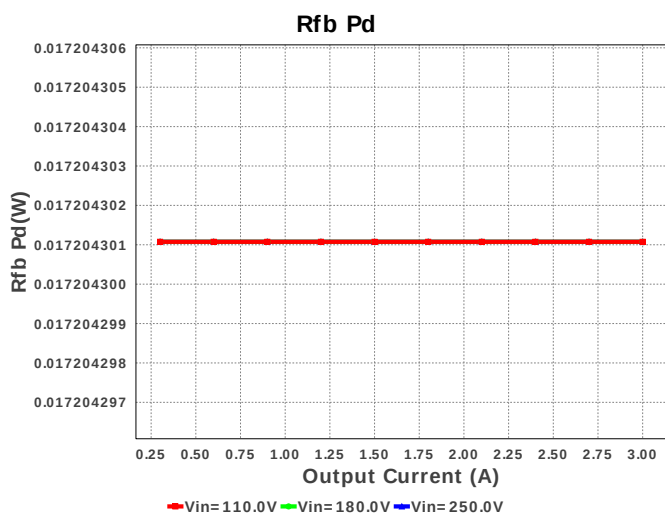
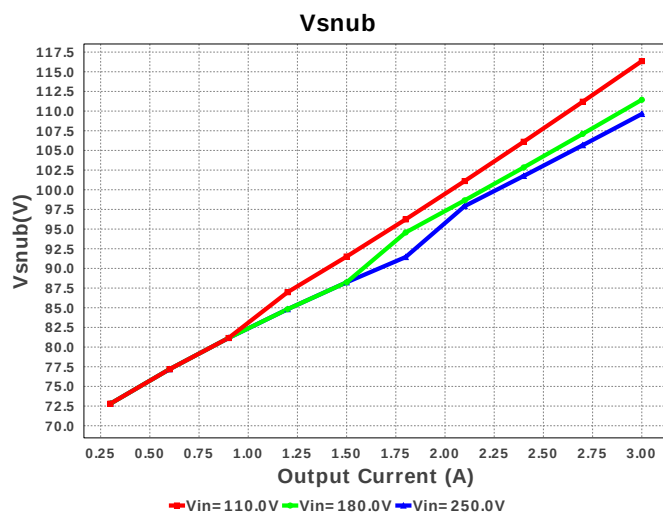
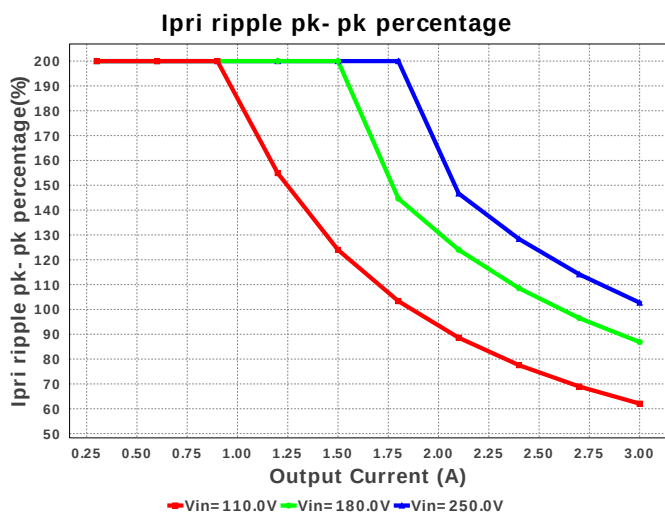


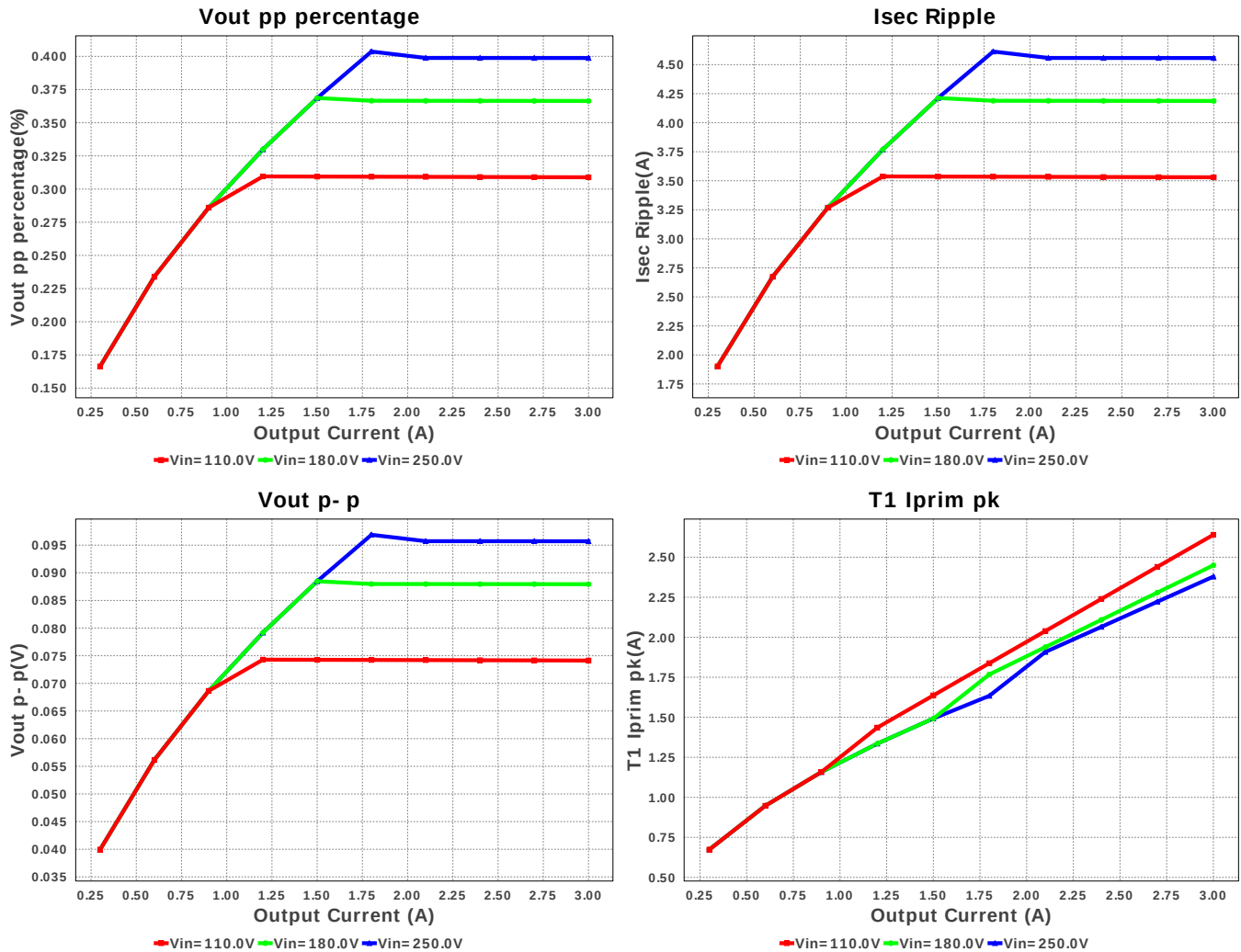












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	3.32 A	Current	Output capacitor1 RMS ripple current
2.	Iin Avg	702.375 mA	Current	Average input current
3.	Iout_DCM	1.099 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	806.6 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	1.25 A	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	62.065 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	3.53 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	1.295 A	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	2.64 A	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	4.475 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	7.453 A	Current	Transformer Secondary1 Peak Current
12.	BOM Count	51	General	Total Design BOM count
13.	Daux trr	16.7 ns	General	Auxiliary Diode Reverse Recovery Time
14.	Dsec Vf	500.0 mV	General	Effective Forward Voltage Drop at the Operating Current
15.	Dsec trr	60.0 ns	General	Output Diode Reverse Recovery Time
16.	Dsec2 Vf	500.0 mV	General	Effective Forward Voltage Drop at the Operating Current
17.	Dsnub trr	30.0 ns	General	Snubber Diode Reverse Recovery Time
18.	FootPrint	4.321 k mm ²	General	Total Foot Print Area of BOM components
19.	Frequency	32.21 kHz	General	Switching frequency
20.	Pout	72.0 W	General	Total output power
21.	Tdead	2.242 kns	General	Approximate Dead Time of the Regulator
22.	Toff	16.376 us	General	Approximate Converter Off Time
23.	Ton Act	12.429 us	General	Approximate Converter On Time
24.	Total BOM	\$0.0	General	Total BOM Cost
25.	Tsw	31.047 us	General	Switching Time Period
26.	Vaux	10.568 V	General	Auxiliary Voltage
27.	Vsnub	116.355 V	General	Voltage Across the Snubber
28.	Vout Actual	24.004 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
29.	Vout OP	24.0 V	Op_Point	Operational Output Voltage

#	Name	Value	Category	Description
30.	Duty Cycle	40.034 %	Op_point	Duty cycle
31.	Efficiency	93.19 %	Op_point	Steady state efficiency
32.	IC Tj	47.755 degC	Op_point	IC junction temperature
33.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
34.	IOUT_OP	3.0 A	Op_point	Iout operating point
35.	M1 TjOP	62.505 degC	Op_point	M1 MOSFET junction temperature
36.	Vout p-p	74.131 mV	Op_point	Peak-to-peak output ripple voltage
37.	Cin Pd	8.569 mW	Power	Input capacitor power dissipation
38.	Cout1 Pd	231.449 mW	Power	Output capacitor1 power dissipation
39.	Dsec Pd	750.0 mW	Power	Secondary Diode Power Dissipation
40.	Dsec2 Pd	750.0 mW	Power	Secondary Diode Power Dissipation
41.	IC Pd	55.102 mW	Power	IC power dissipation
42.	L2 Pd	21.6 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
43.	M1 Pd	280.084 mW	Power	M1 MOSFET total power dissipation
44.	Paux	17.484 mW	Power	Power Dissipation in Raux and Daux
45.	Pd Rstartup	121.604 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
46.	Rdrv Pd	25.462 μ W	Power	Power Dissipation in Gate Drive Resistor
47.	Rfb Pd	17.204 mW	Power	Rfb Power Dissipation
48.	Rsns Pd	419.321 mW	Power	Current Limit Sense Resistor Power Dissipation
49.	Snubber Pd	1.391 W	Power	Snubber Power Dissipation
50.	T1 Pd	3.263 W	Power	Estimated Losses in Transformer
51.	Total Pd	0.0 W	Power	Total Power Dissipation
52.	Vout Tolerance	2.137 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
53.	Vout pp percentage	308.879 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	3.0	Maximum Output Current
2.	Iout1	3.0	Output Current #1
3.	Iout2	1.0	Output Current #2
4.	Iout3	1.0	Output Current #3
5.	VinMax	250.0	Maximum input voltage
6.	VinMin	110.0	Minimum input voltage
7.	Vout	24.0	Output Voltage
8.	Vout1	24.0	Output Voltage #1
9.	Vout2	12.0	Output Voltage #2
10.	Vout3	5.0	Output Voltage #3
11.	base_pn	UCC38C41	Texas Instruments Base Part Number
12.	source	DC	Input Source Type
13.	ta	45.0	Ambient temperature

Design Assistance

1. UCC38C41 Product Folder : <http://www.ti.com/product/UCC38C41> : contains the data sheet and other resources.

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