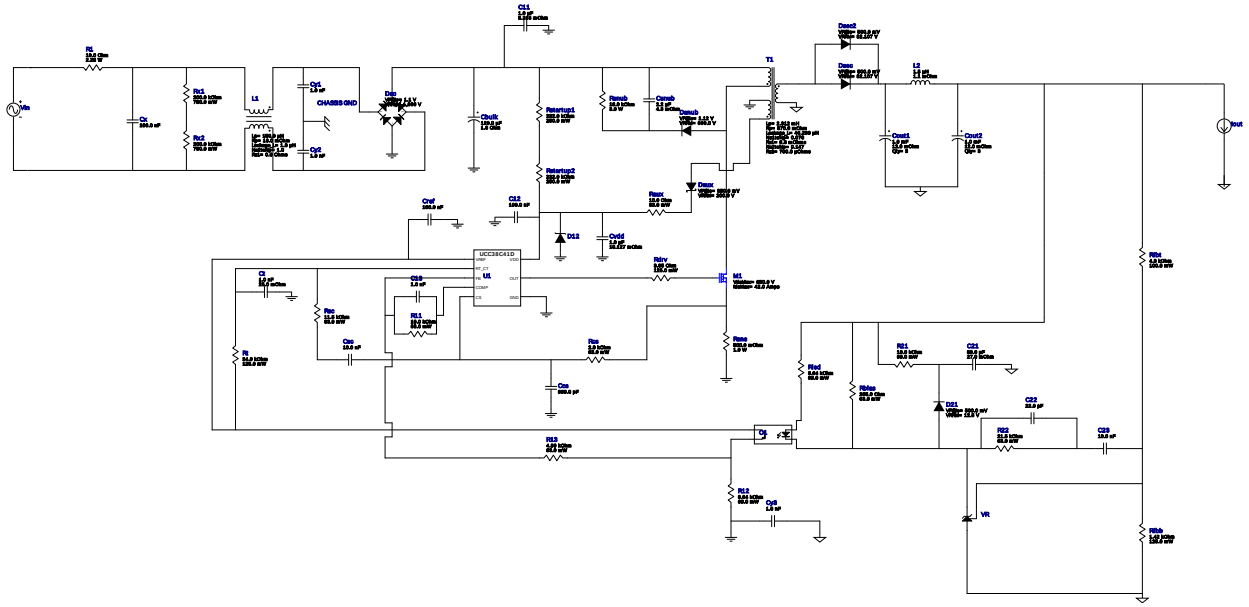
VinMin = 110.0V
VinMax = 260.0V
Vout = 5.0V
Iout = 9.0A

Device = UCC38C41DR
Topology = Flyback
Created = 8/12/16 1:12:28 AM
BOM Cost = $0.00
BOM Count = 58
Total Pd = 7.4W

WEBENCH® Design Report

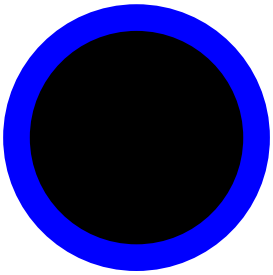
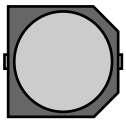
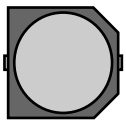
Design : 1836019/66 UCC38C41DR
UCC38C41DR 110.0V-260.0V to 5.00V @ 9.0A

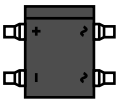
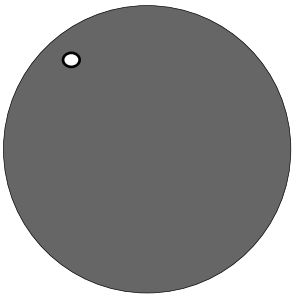
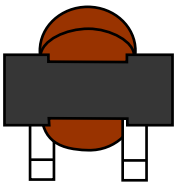


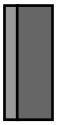
1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.

Electrical BOM

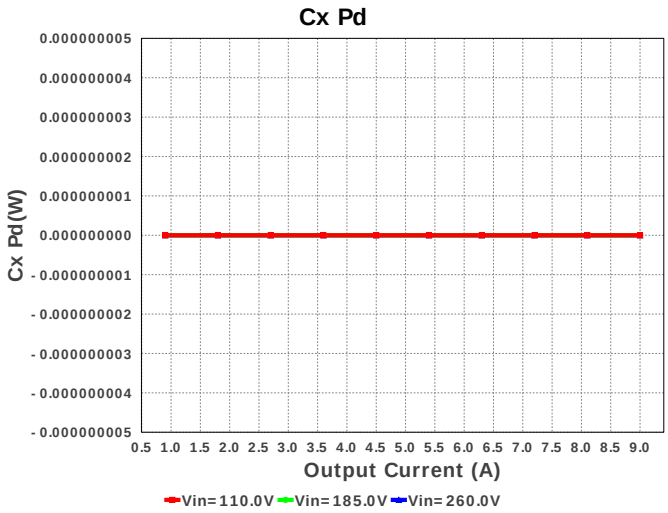
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C11	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	$1.19	2220 54 mm^2
2.	C12	MuRata	GRM155R61C104KA88D Series= X5R	Cap= 100.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
3.	C13	MuRata	GRM033R71C102KA01D Series= X7R	Cap= 1.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm^2
4.	C21	Panasonic	16SVPC39MV Series= SVPC	Cap= 39.0 uF ESR= 27.0 mOhm VDC= 16.0 V IRMS= 2.35 A	1	$0.28	SM_RADIAL_5MM 58 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	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2

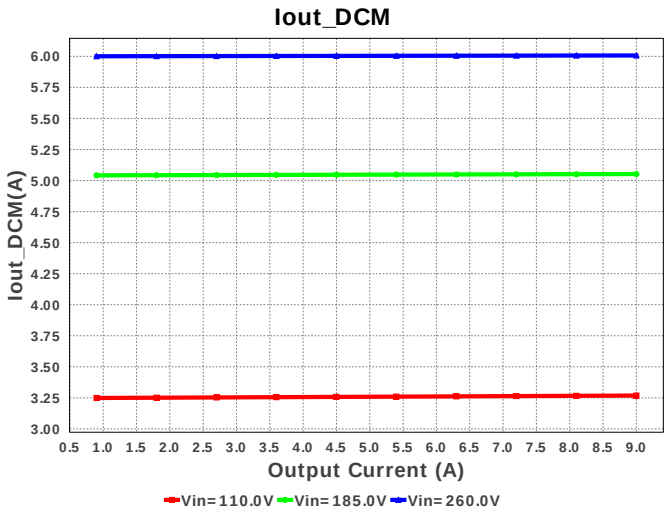
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cbulk	Vishay-Bccomponents	MAL215757121E3 Series= 2239	Cap= 120.0 uF ESR= 1.6 Ohm VDC= 450.0 V IRMS= 1.09 A	1	$3.90	 157PUM-SI_2500x3000 729 mm^2
8.	Ccs	MuRata	GRM033R71C681KA01D Series= X7R	Cap= 680.0 pF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	 0201 2 mm^2
9.	Cout1	Panasonic	16SVPF1000M Series= ?	Cap= 1.0 mF ESR= 12.0 mOhm VDC= 16.0 V IRMS= 5.4 A	3	$0.74	 CAPSMT_62_F12 151 mm^2
10.	Cout2	Panasonic	16SVPF1000M Series= ?	Cap= 1.0 mF ESR= 12.0 mOhm VDC= 16.0 V IRMS= 5.4 A	3	$0.74	 CAPSMT_62_F12 151 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.	Csc	MuRata	GRM033R60J103KA01D Series= X5R	Cap= 10.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	 0201 2 mm^2
13.	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
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	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
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

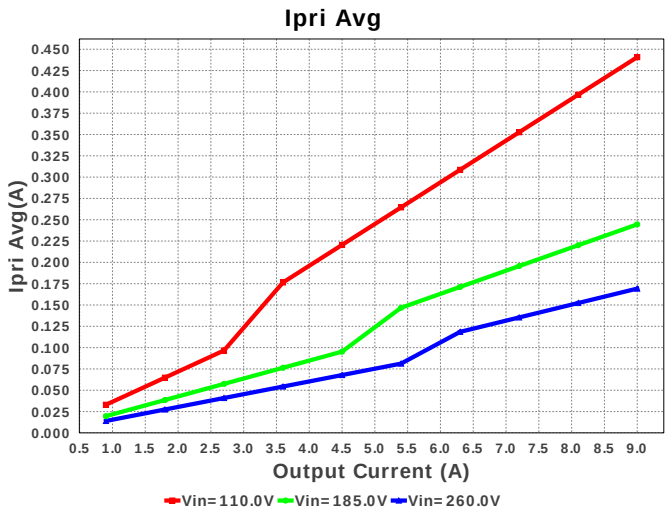
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
18.	Cy2	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	$0.22	 B81123_1800x500x1050 140 mm²
19.	Cy3	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF VDC= 3.0 kV IRMS= 0.0 A	1	$0.22	 B81123_1800x500x1050 140 mm²
20.	D12	Diodes Inc.	DFLZ18-7	Zener	1	$0.13	 PowerDI123 13 mm²
21.	D21	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 12.5 V	1	NA	CUSTOM 0 mm²
22.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	$0.24	 DF-S 99 mm²
23.	Daux	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	$0.21	 PowerDI123 13 mm²
24.	Dsec	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 82.107 V	1	NA	CUSTOM 0 mm²
25.	Dsec2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 82.107 V	1	NA	CUSTOM 0 mm²
26.	Dsnub	Bourns	CD214C-F3600	VF@Io= 1.12 V VRRM= 600.0 V	1	$0.18	 SMC 83 mm²
27.	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	$5.95	 CM6296 833 mm²
28.	L2	Coilcraft	SER1590-152MLB	L= 1.5 µH DCR= 1.1 mOhm	1	$1.12	 SER1590 324 mm²

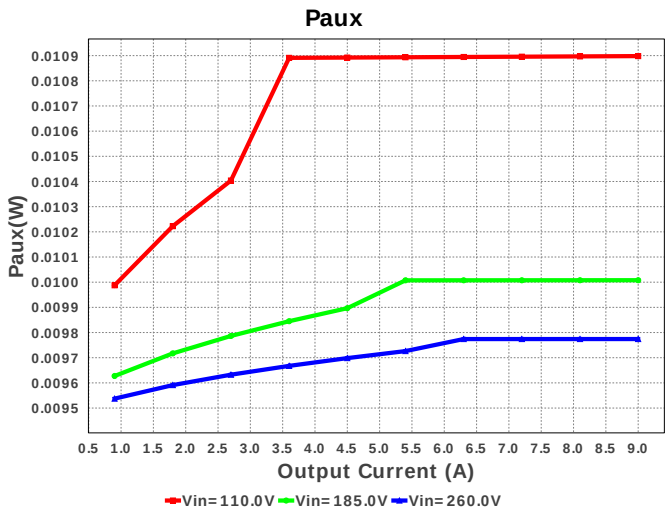
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
29.	M1	STMicroelectronics	STP57N65M5	VdsMax= 650.0 V IdsMax= 42.0 Amps	1	$7.05	 TO-220AB 397 mm²
30.	O1	Vishay-Semiconductor	TCMT1109	Optocoupler	1	$0.21	 SOP-4 44 mm²
31.	R1	Vishay-Dale	AC03000001009JACCS Series= F_RES	Res= 10.0 Ohm Power= 2.25 W Tolerance= 5.0%	1	$0.30	 AC03 158 mm²
32.	R11	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
33.	R12	Vishay-Dale	CRCW04026K04FKED Series= CRCW..e3	Res= 6.04 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
34.	R13	Vishay-Dale	CRCW04024K99FKED Series= CRCW..e3	Res= 4.99 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
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	CRCW040221K5FKED Series= CRCW..e3	Res= 21.5 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	CRCW0402205RFKED 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	CRCW08053R65FKEA Series= CRCW..e3	Res= 3.65 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 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.	Rfbt	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	CRCW04026K04FKED Series= CRCW..e3	Res= 6.04 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
44.	Rsc	Vishay-Dale	CRCW040211K5FKED Series= CRCW..e3	Res= 11.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
45.	Rsns	Stackpole Electronics Inc	CSRN2010FKR500 Series= ?	Res= 500.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.10	 2010 32 mm²
46.	Rsnub	Vishay-Bccomponents	PR030002018O2JAC00 Series= ?	Res= 18.0 kOhm Power= 3.0 W Tolerance= 5.0%	1	$0.19	 PR03 0 mm²
47.	Rstartup1	Panasonic	ERJ-8ENF2323V Series= ERJ-8E	Res= 232.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm²
48.	Rstartup2	Panasonic	ERJ-8ENF2323V Series= ERJ-8E	Res= 232.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm²

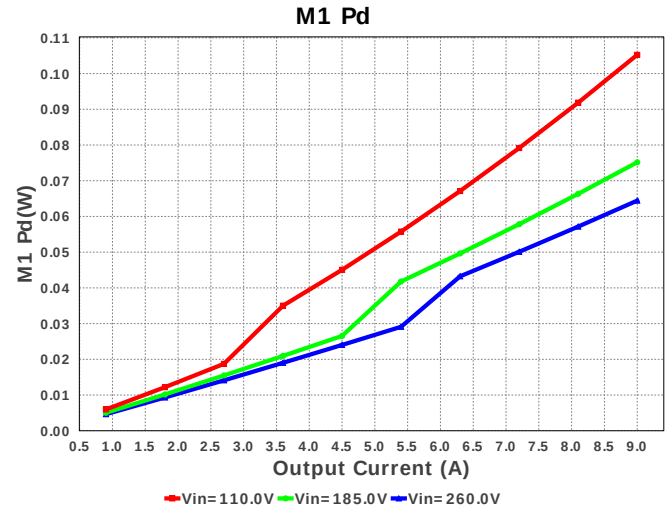
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
49.	Rt	Panasonic	ERJ-6ENF3402V Series= ERJ-6E	Res= 34.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
50.	Rx1	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	$0.03	 2010 32 mm^2
51.	Rx2	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	$0.03	 2010 32 mm^2
52.	T1	CUSTOM	CUSTOM	Lp= 2.312 mH Rp= 870.0 mOhm Leakage_L= 46.233 µH Ns1toNp= 0.076 Rs1= 8.6 mOhms Ns2toNp= 0.147 Rs2= 700.0 µOhms	1	NA	CUSTOM 0 mm^2
53.	U1	Texas Instruments	UCC38C41DR	Switcher	1	$0.70	 D0008A 57 mm^2
54.	VR	Texas Instruments	LMV431CM5/NOPB	Voltage References	1	$0.16	 R-PDSO-G3 16 mm^2

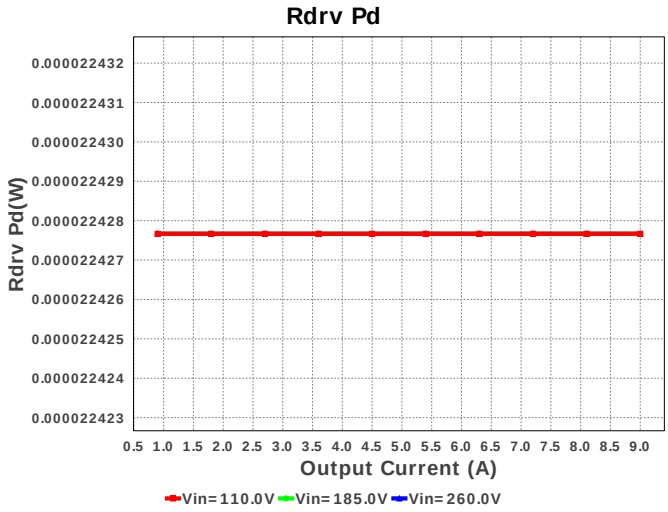


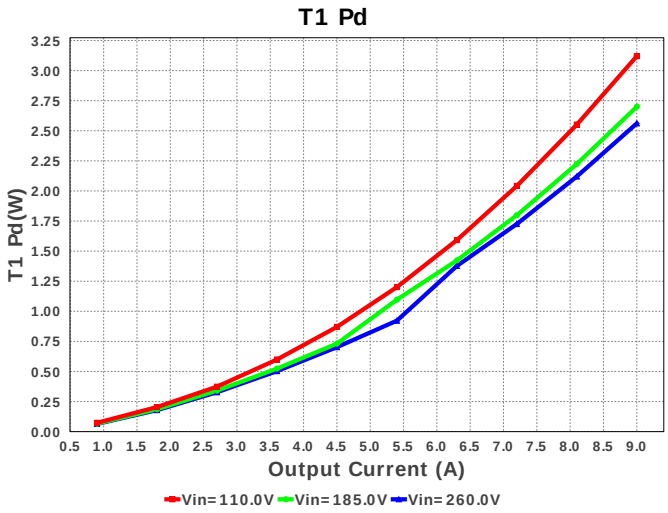


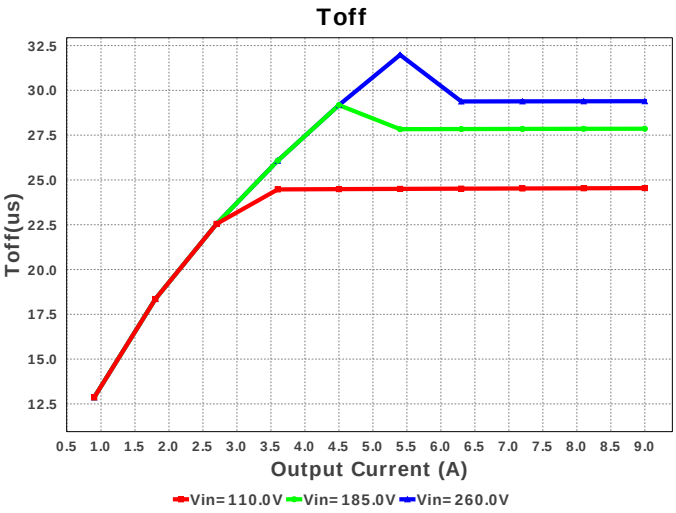


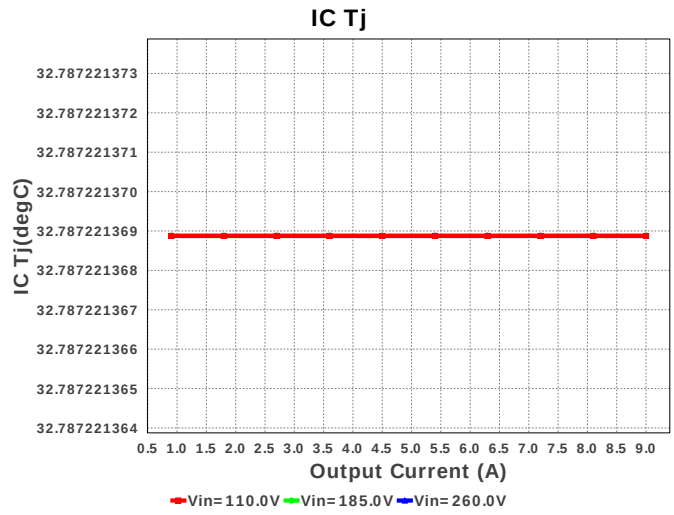


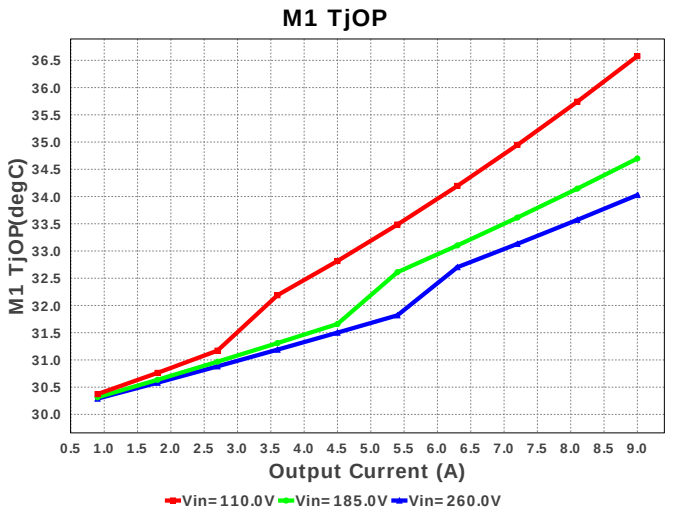


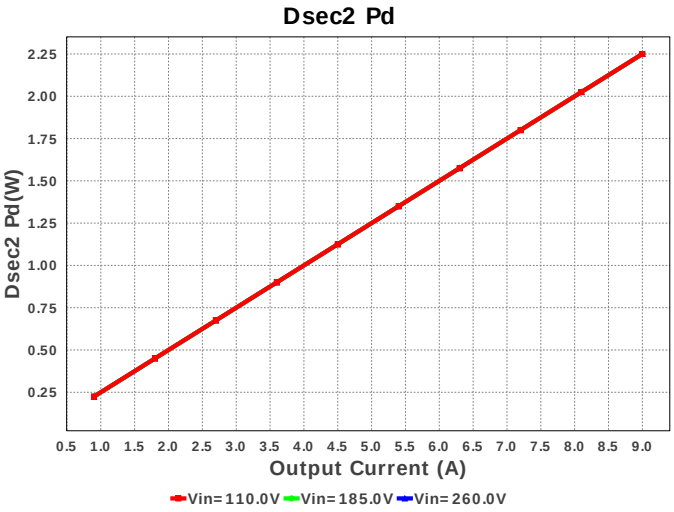


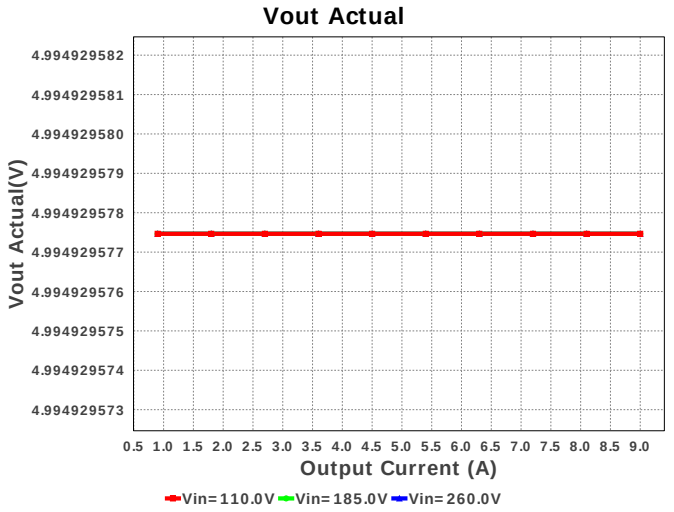


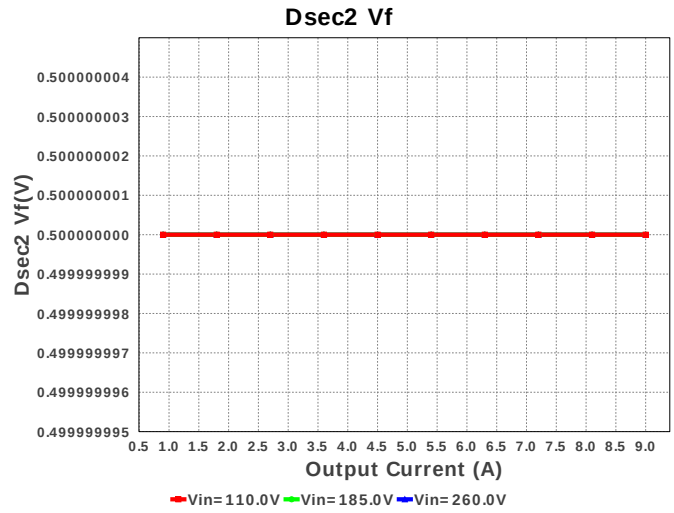


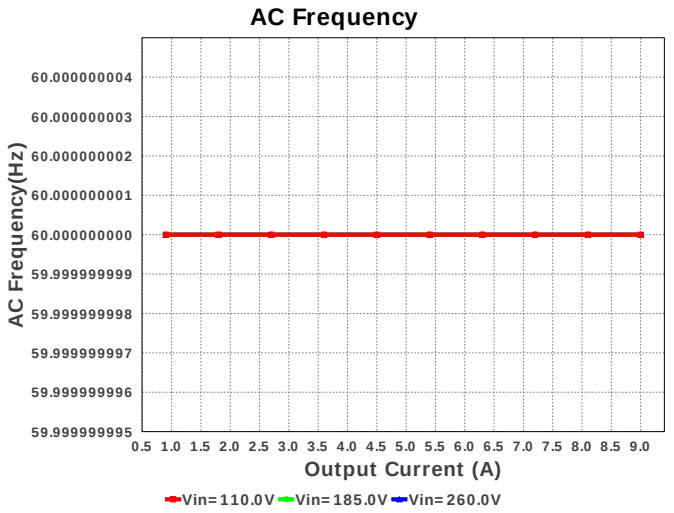


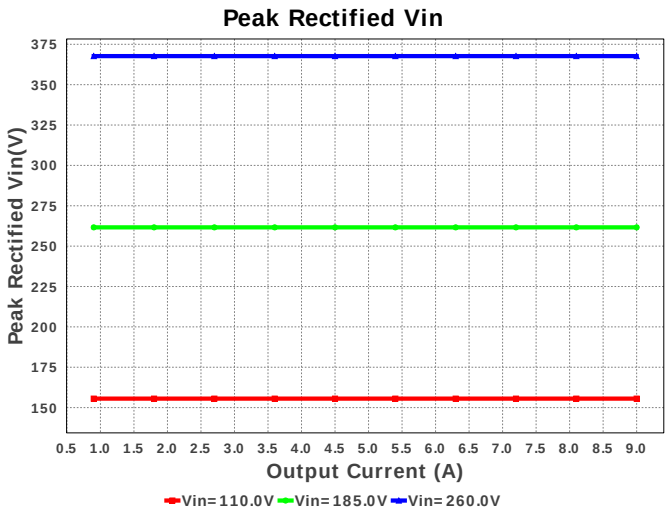


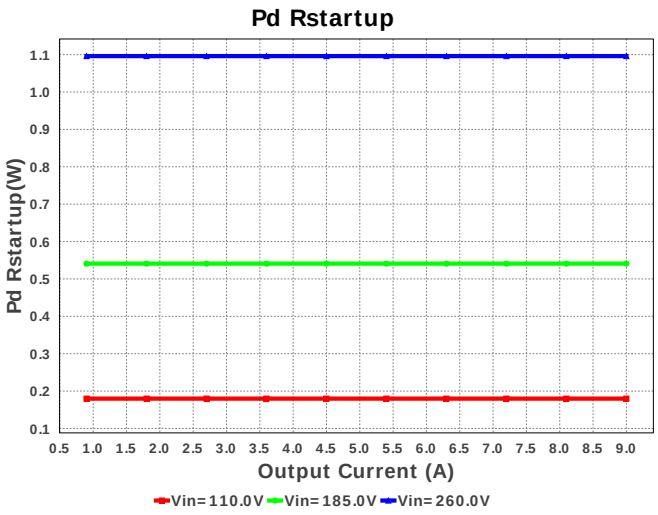


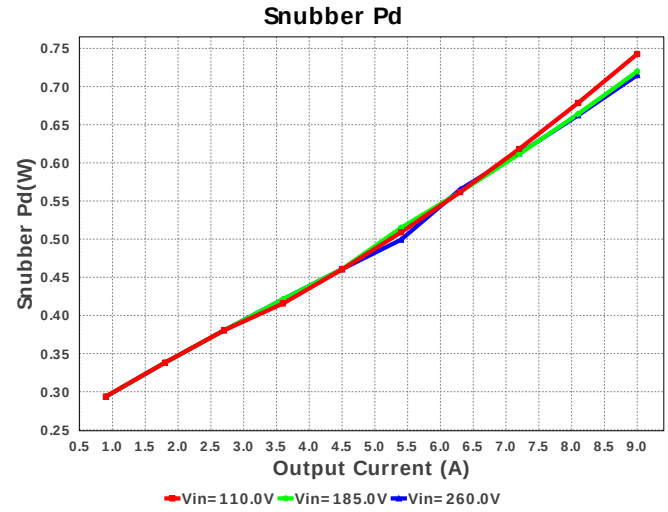


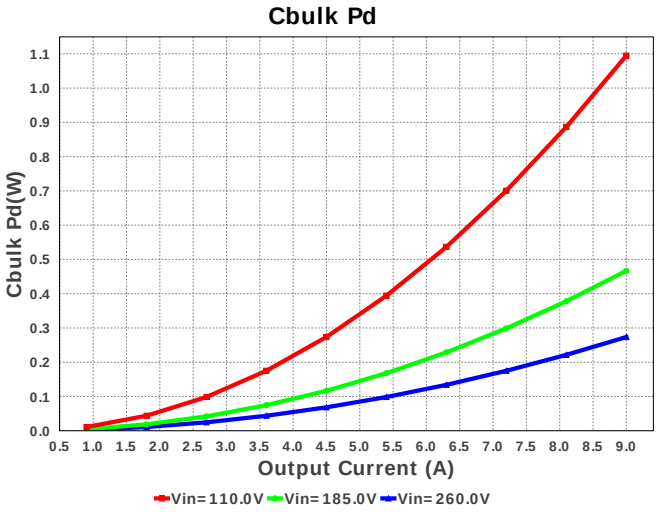


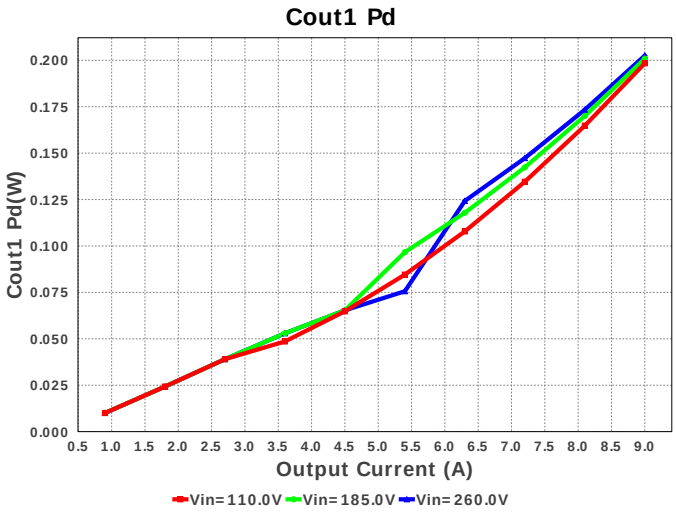


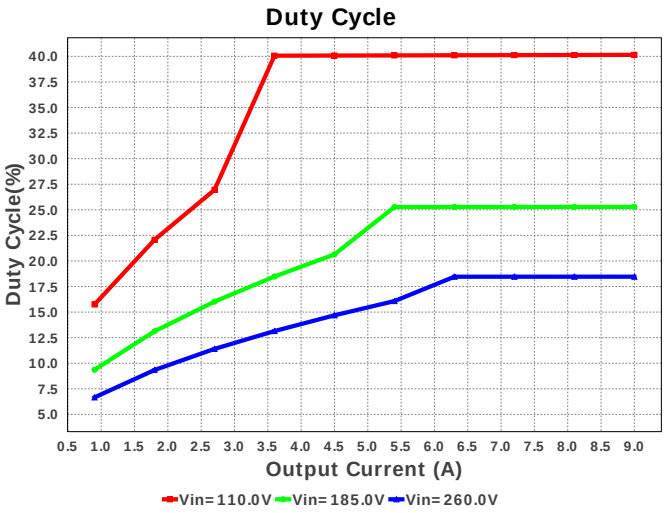


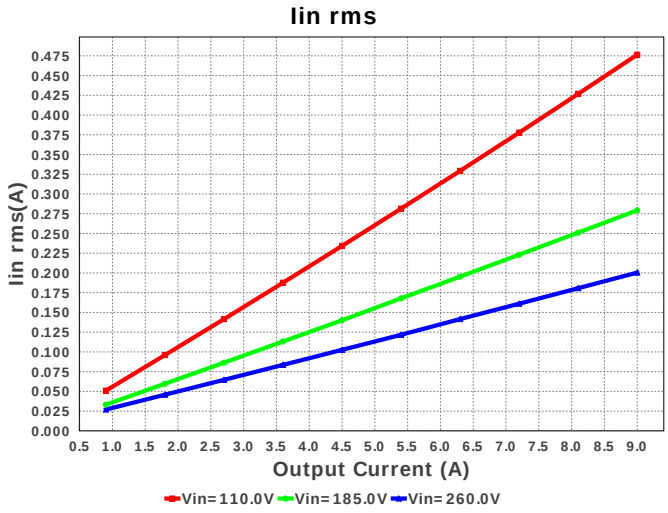


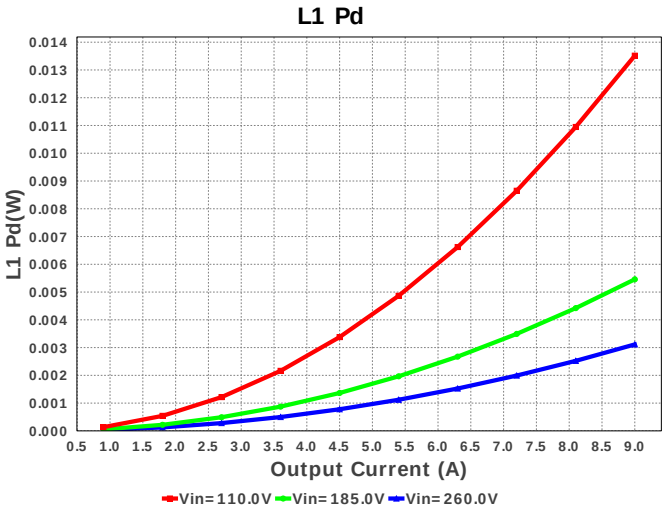


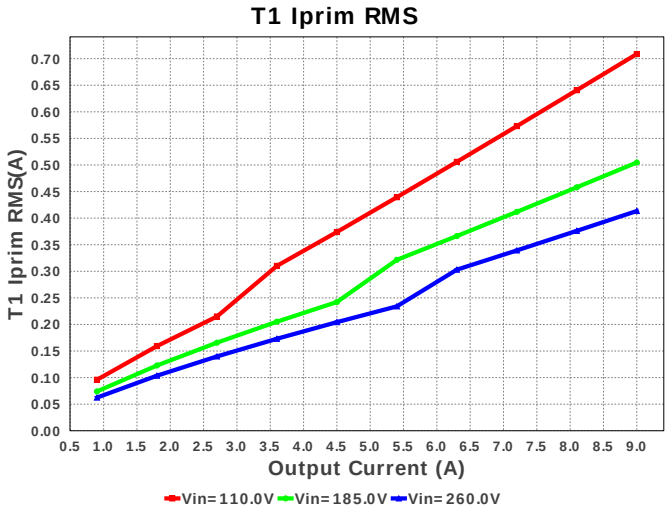


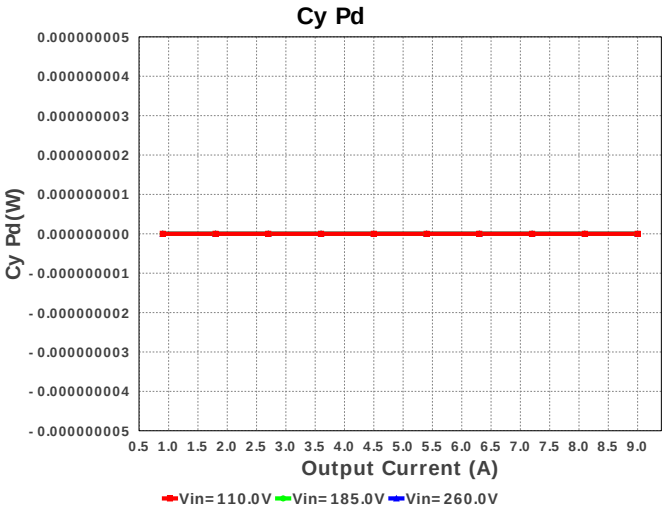


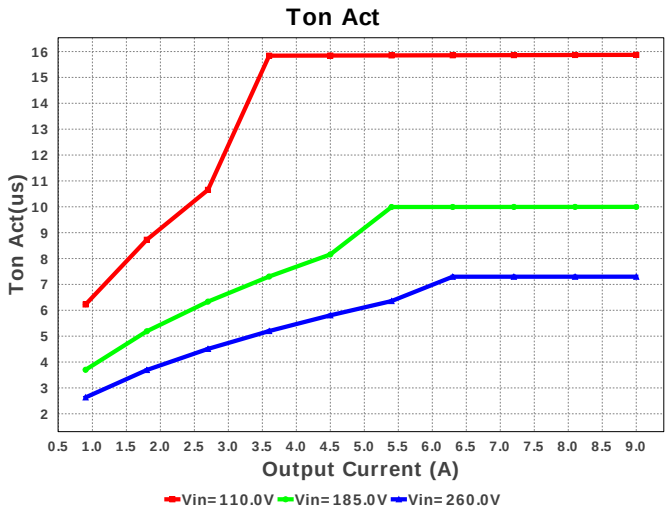


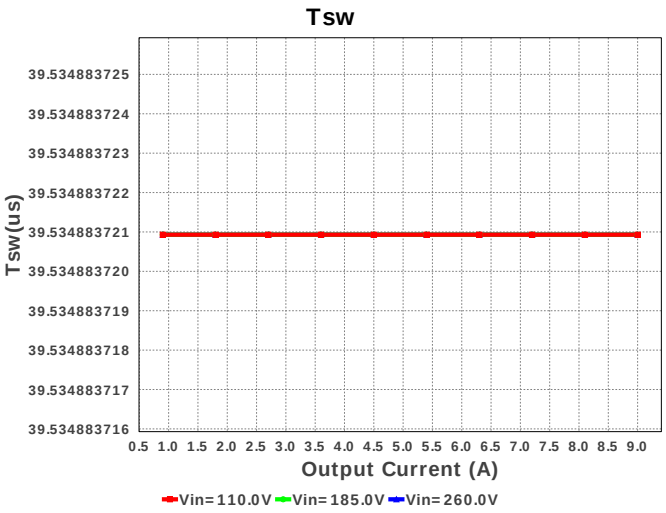


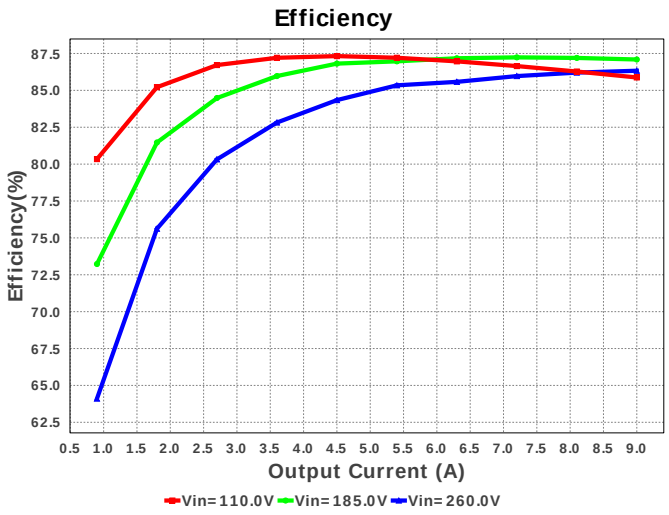


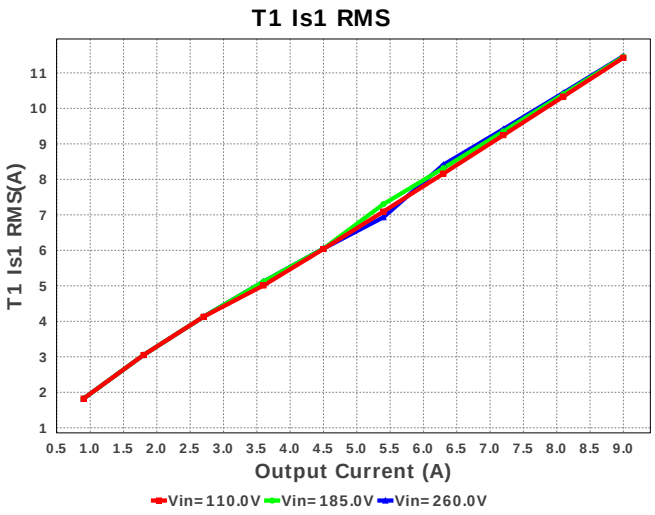


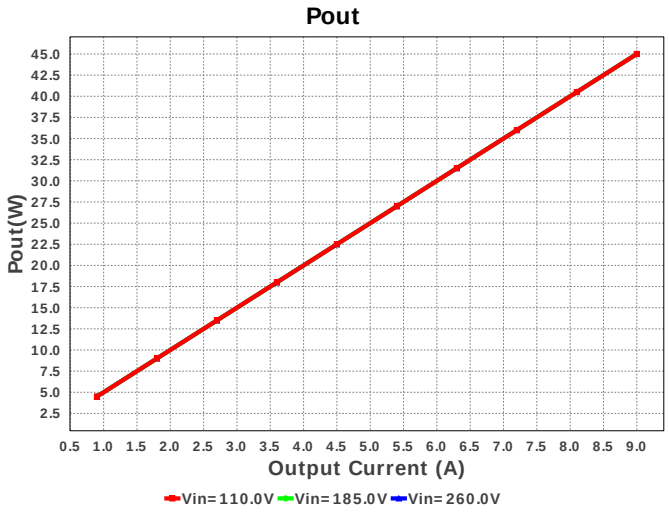


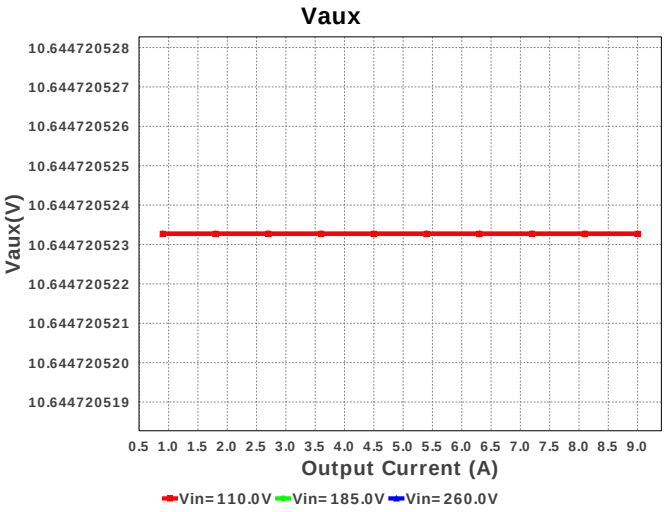


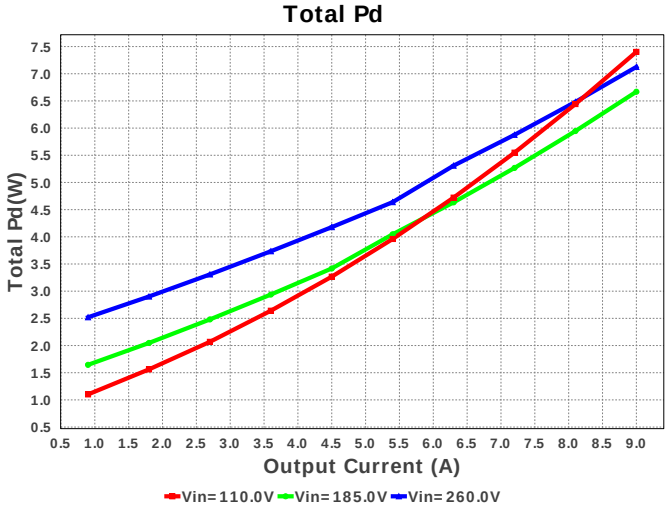


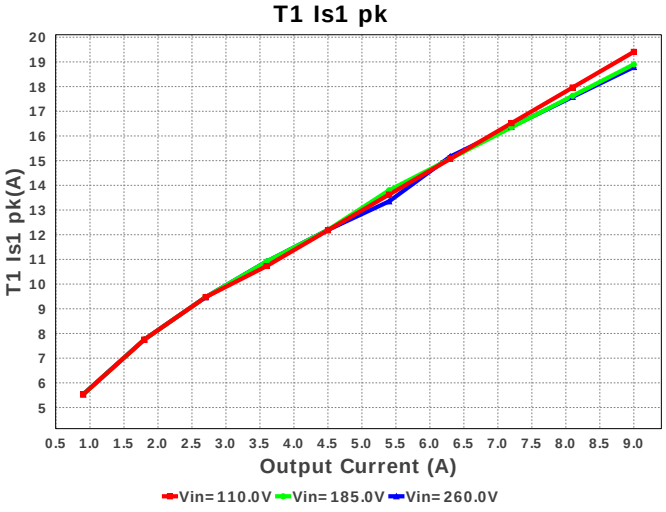


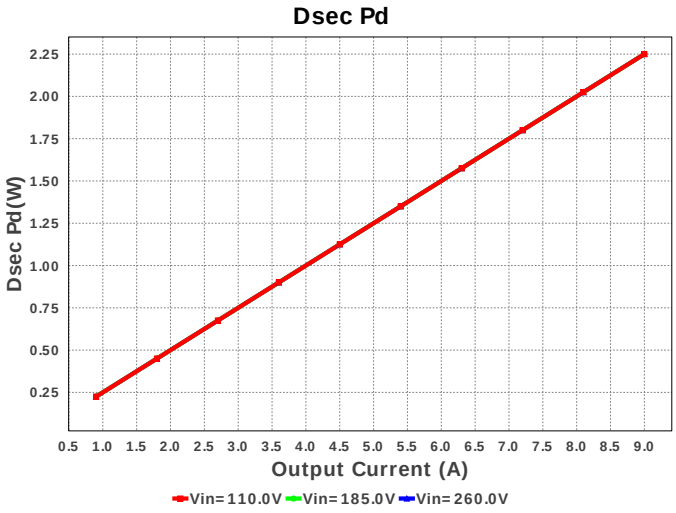


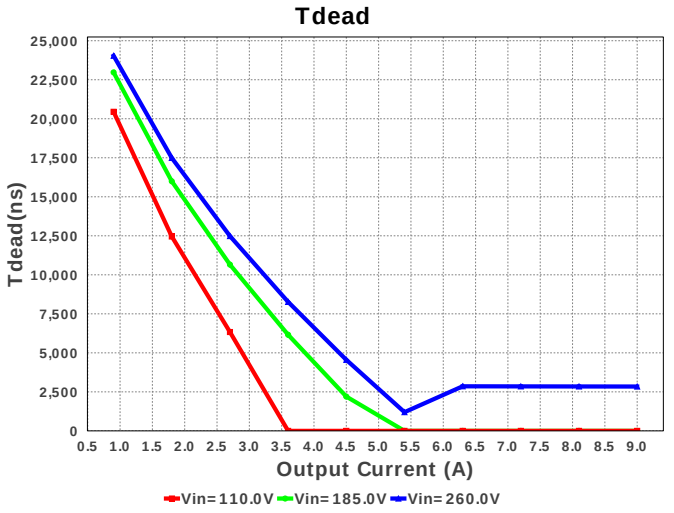


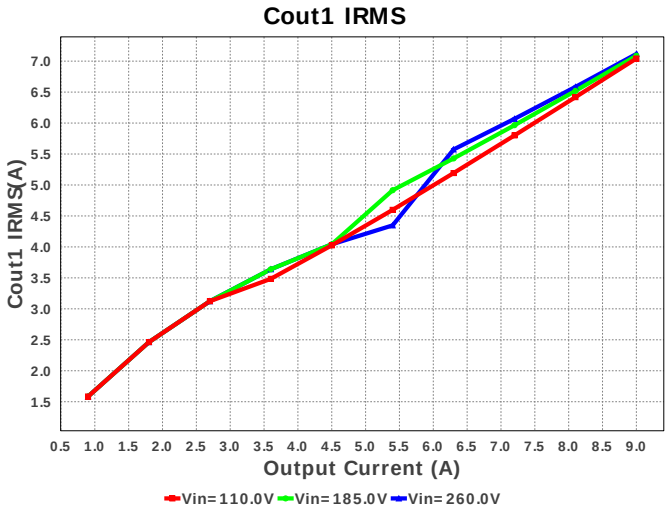


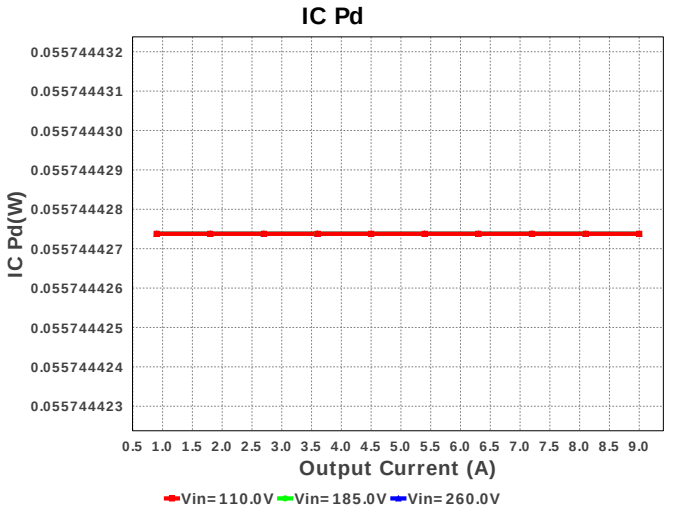


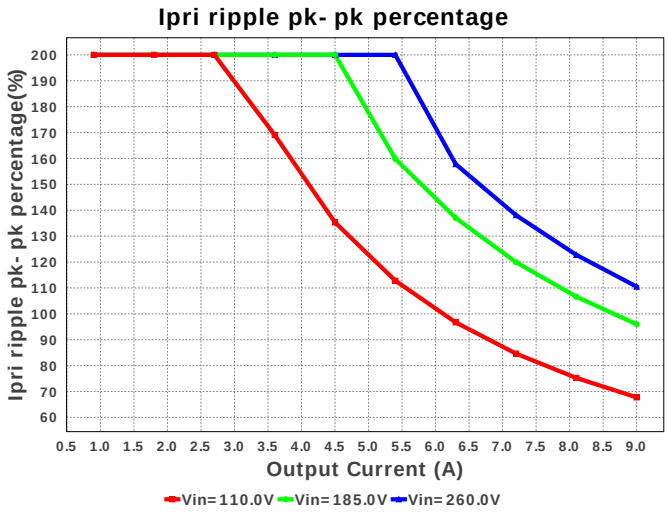


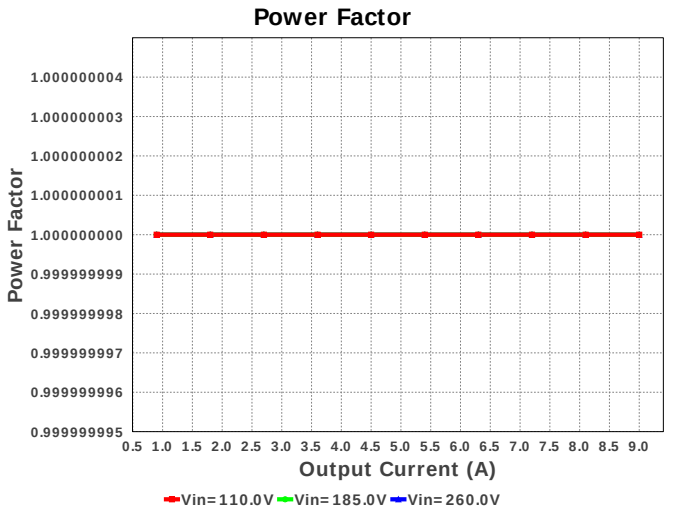


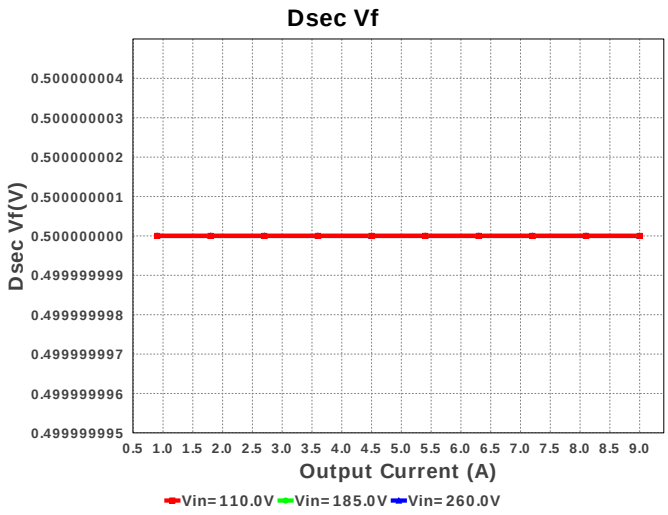


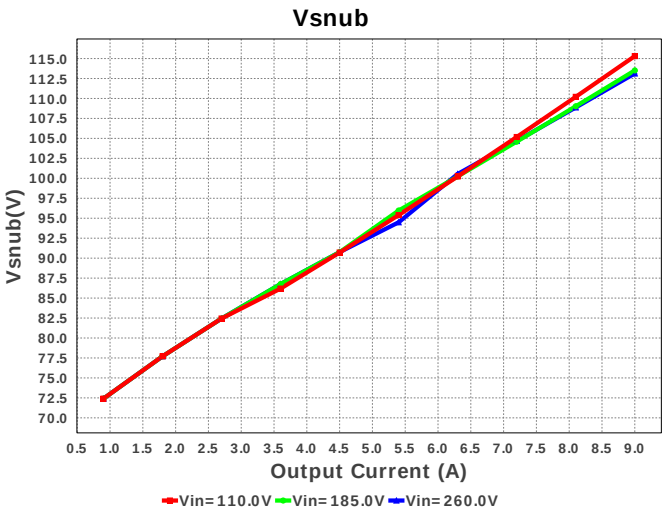


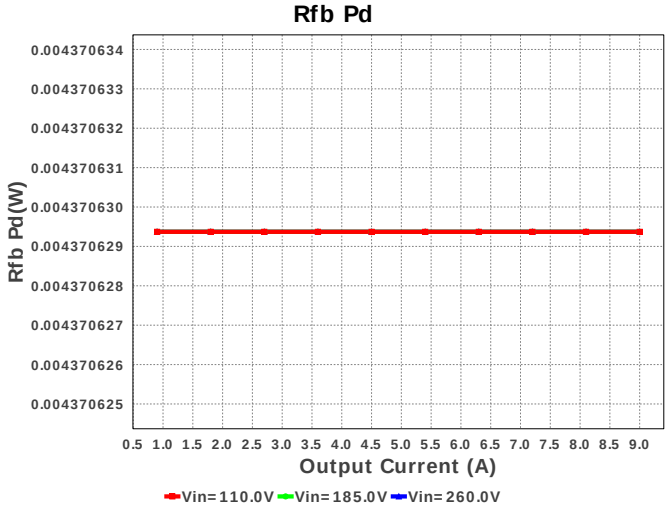


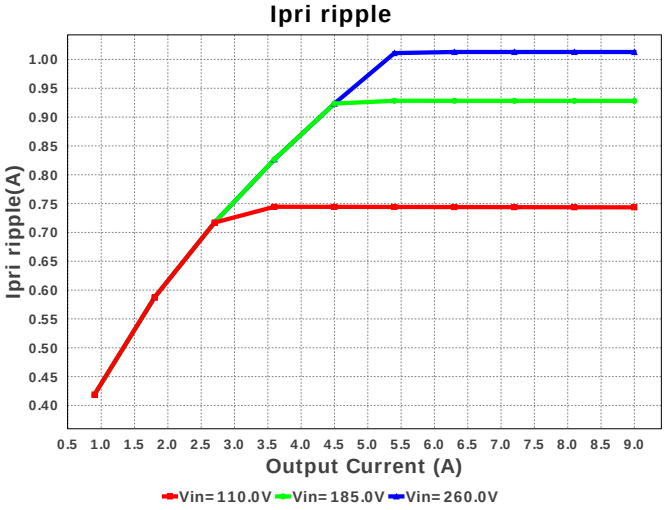


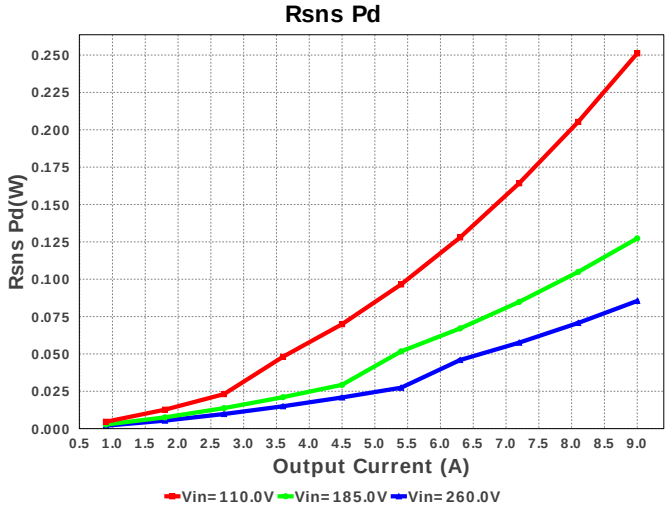


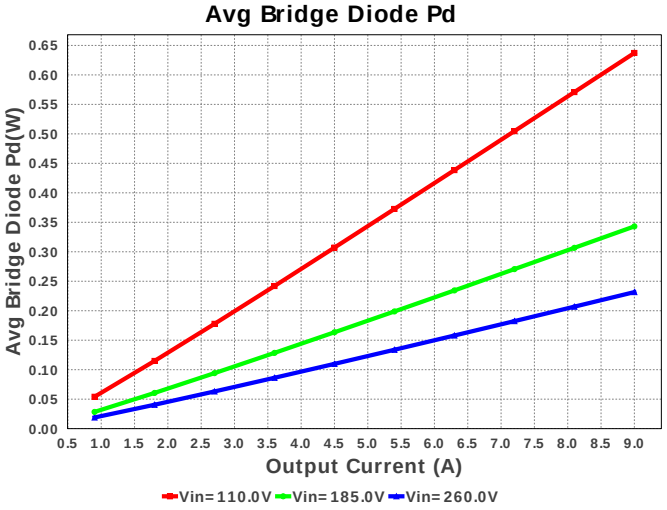


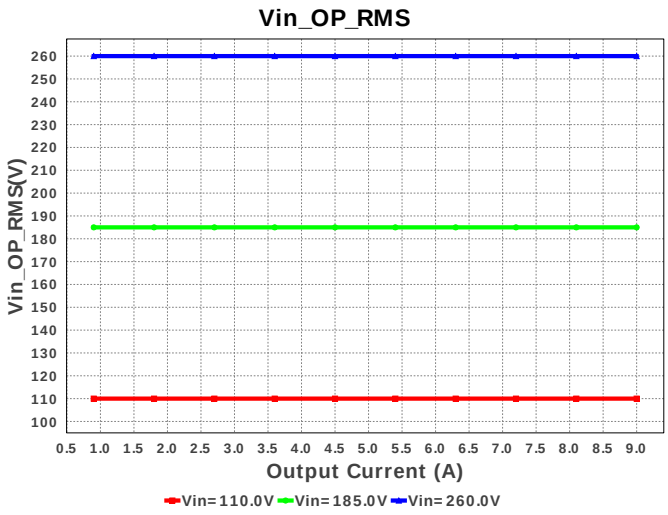


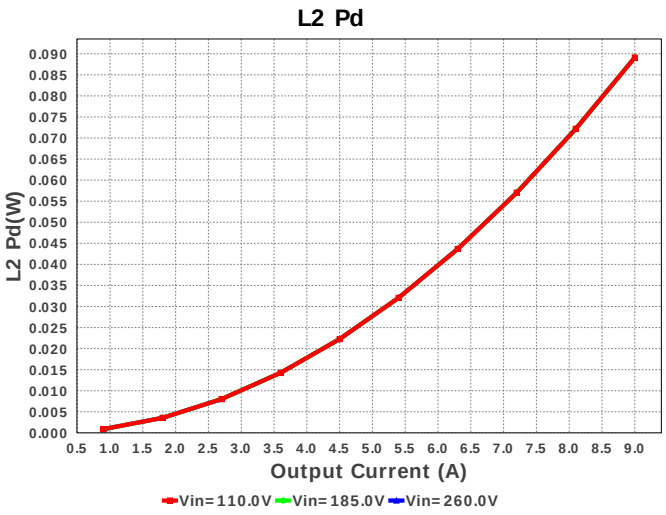


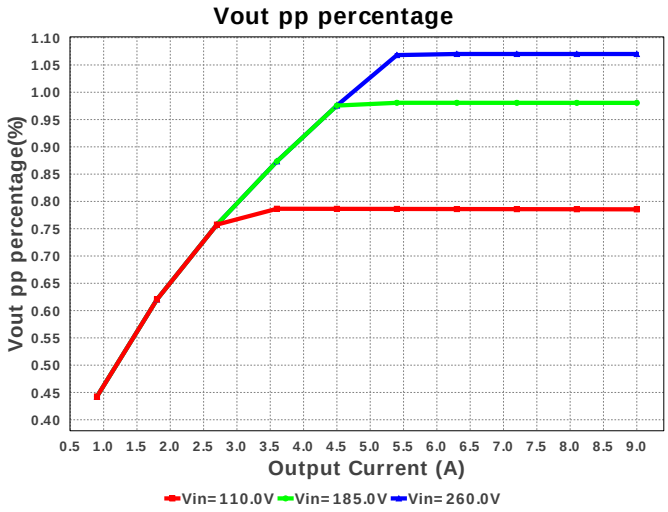


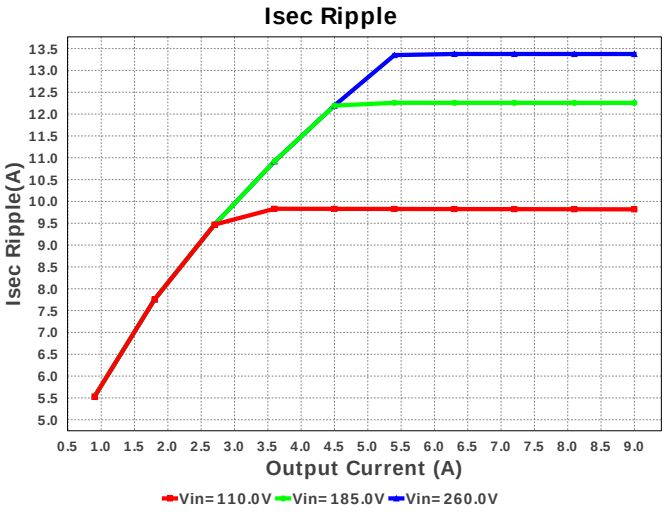


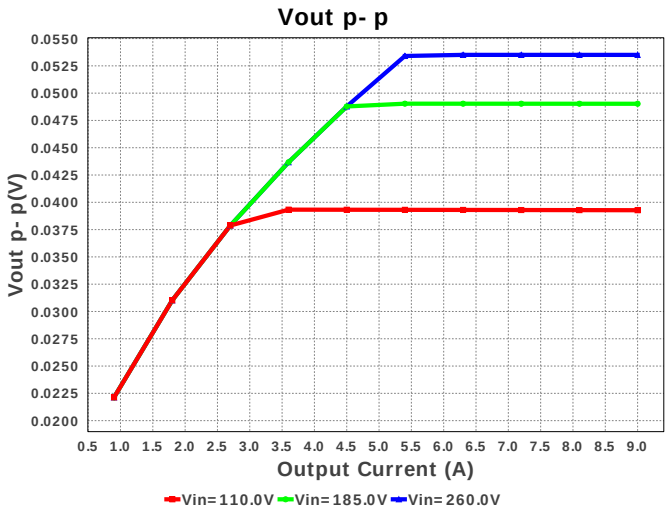


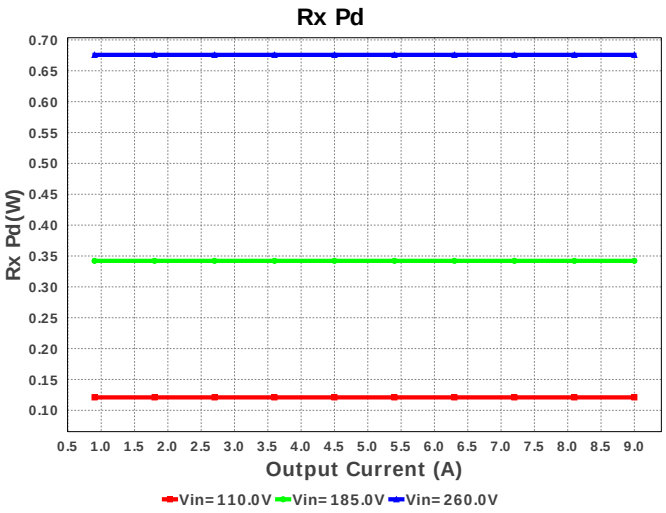


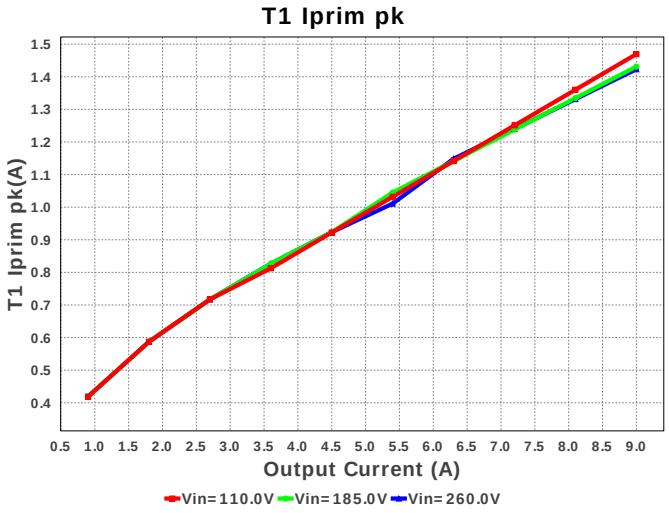












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	7.043 A	Current	Output capacitor1 RMS ripple current
2.	Iin rms	476.39 mA	Current	RMS Input Current
3.	Iout_DCM	3.268 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	440.701 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	743.51 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	67.731 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	9.819 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	708.712 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	1.47 A	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	11.428 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	19.406 A	Current	Transformer Secondary1 Peak Current
12.	AC Frequency	50.0 Hz	General	Input AC frequency
13.	BOM Count	58	General	Total Design BOM count
14.	Daux trr	0.0 ns	General	Auxiliary Diode Reverse Recovery Time
15.	Dsec Vf	500.0 mV	General	Effective Forward Voltage Drop at the Operating Current
16.	Dsec trr	60.0 ns	General	Output Diode Reverse Recovery Time
17.	Dsec2 Vf	500.0 mV	General	Effective Forward Voltage Drop at the Operating Current
18.	Dsnub trr	30.0 ns	General	Snubber Diode Reverse Recovery Time
19.	FootPrint	4.816 k mm^2	General	Total Foot Print Area of BOM components
20.	Frequency	25.294 kHz	General	Switching frequency
21.	Mode	CCM	General	Conduction Mode
22.	Pout	45.0 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	24.544 us	General	Approximate Converter Off Time
26.	Ton Act	15.872 us	General	Approximate Converter On Time
27.	Total BOM	$0.0	General	Total BOM Cost
28.	Tsw	39.535 us	General	Switching Time Period
29.	Vaux	10.645 V	General	Auxiliary Voltage
30.	Vsnub	115.307 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	40.146 %	Op_point	Duty cycle
34.	Efficiency	85.874 %	Op_point	Steady state efficiency
35.	IC Tj	32.787 degC	Op_point	IC junction temperature
36.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
37.	IOUT_OP	9.0 A	Op_point	Iout operating point
38.	M1 TjOP	36.578 degC	Op_point	M1 MOSFET junction temperature
39.	Peak Rectified Vin	155.562 V	Op_point	Peak voltage seen at rectified input
40.	Vin_OP_RMS	110.0 V	Op_point	AC Input RMS Voltage
41.	Vout p-p	39.275 mV	Op_point	Peak-to-peak output ripple voltage
42.	Avg Bridge Diode Pd	637.217 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
43.	Cbulk Pd	1.095 W	Power	Bulk capacitor power dissipation
44.	Cout1 Pd	198.391 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	2.25 W	Power	Secondary Diode Power Dissipation
48.	Dsec2 Pd	2.25 W	Power	Secondary Diode Power Dissipation
49.	IC Pd	55.744 mW	Power	IC power dissipation
50.	L1 Pd	13.514 mW	Power	Power Dissipation in the Inductor

#	Name	Value	Category	Description
51.	L2 Pd	89.1 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
52.	M1 Pd	105.246 mW	Power	M1 MOSFET total power dissipation
53.	Paux	10.898 mW	Power	Power Dissipation in Raux and Daux
54.	Pd Rstartup	179.87 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
55.	Rdrv Pd	22.428 µW	Power	Power Dissipation in Gate Drive Resistor
56.	Rfb Pd	4.371 mW	Power	Rfb Power Dissipation
57.	Rsns Pd	251.136 mW	Power	Current Limit Sense Resistor Power Dissipation
58.	Rx Pd	120.961 mW	Power	Total Power Dissipation in Rx1 and Rx2
59.	Snubber Pd	742.703 mW	Power	Snubber Power Dissipation
60.	T1 Pd	3.12 W	Power	Estimated Losses in Transformer
61.	Total Pd	7.402 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	785.505 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	9.0	Maximum Output Current
2.	VinMax	260.0	Maximum input voltage
3.	VinMin	110.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	line_fsw	50.0	Light Output in Lumen
6.	base_pn	UCC38C41	Base Product Number
7.	source	AC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

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