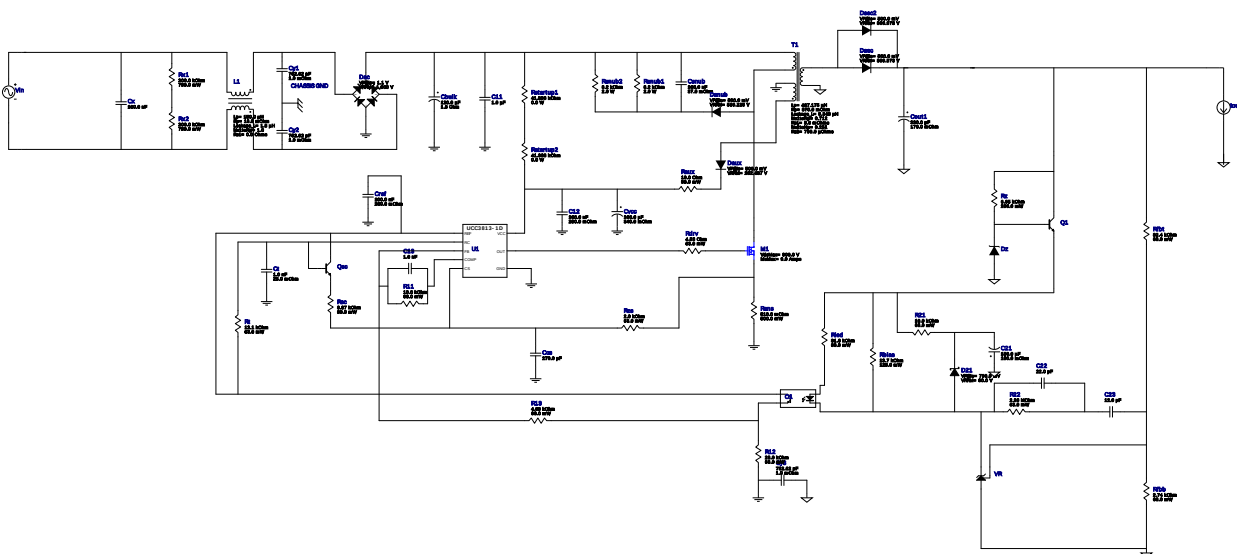


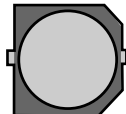
WEBENCH® Design Report

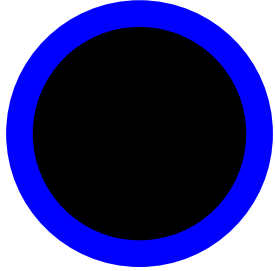
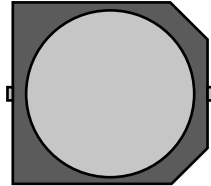
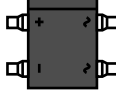
Design : 4551144/154 UCC3813DTR-1
UCC3813DTR-1 70.0V-290.0V to 32.00V @ 0.75A

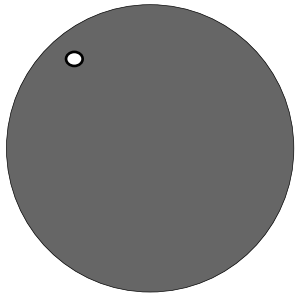


1. The EMI filter selected here contains the estimated values. The real numbers will depend on the attenuation needed at a particular frequency.

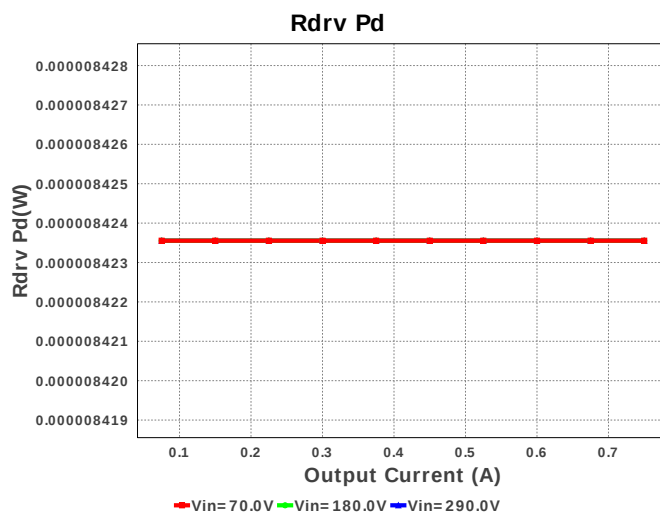
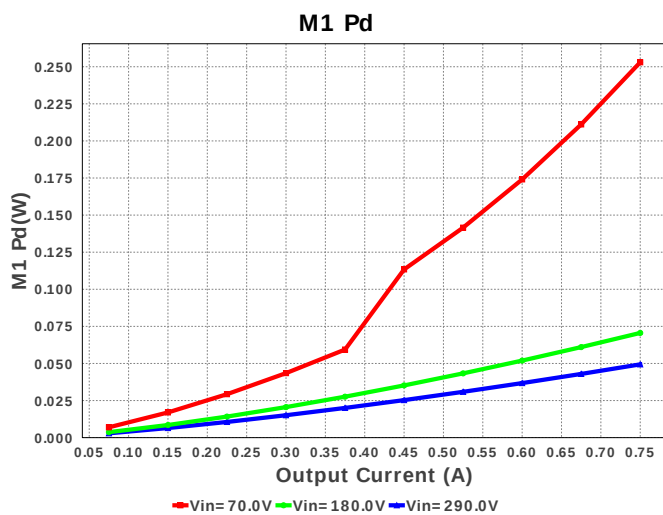
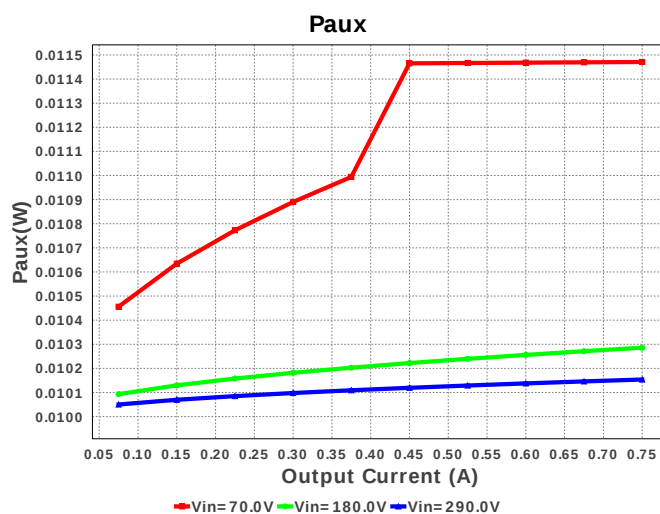
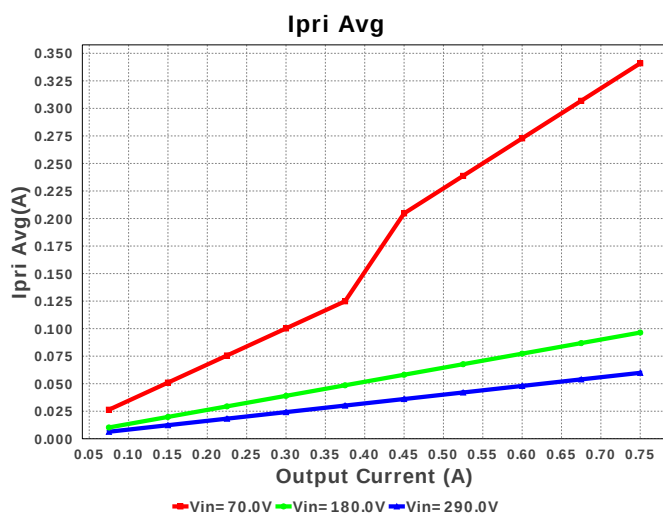
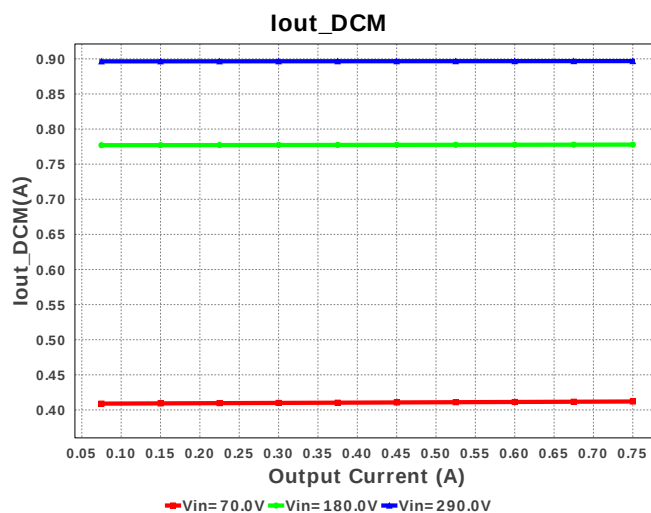
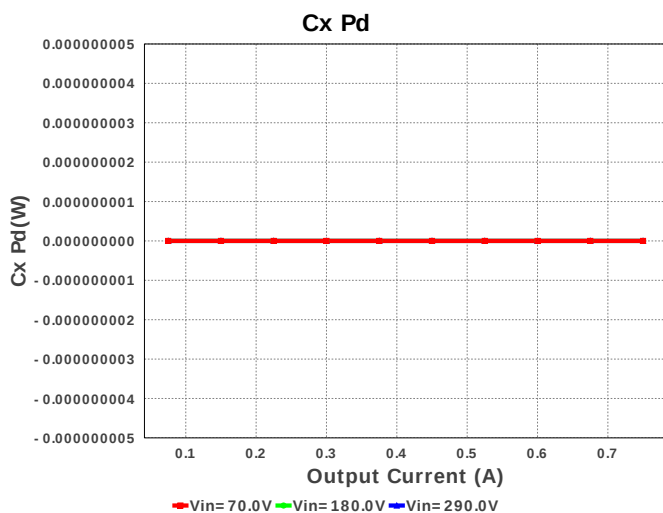
Electrical BOM

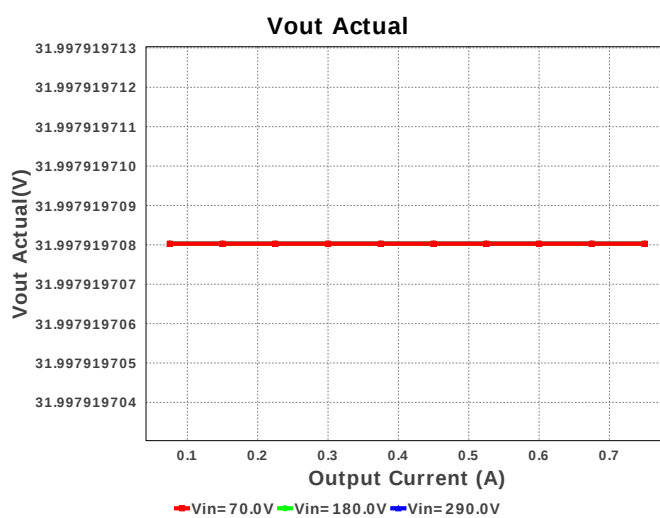
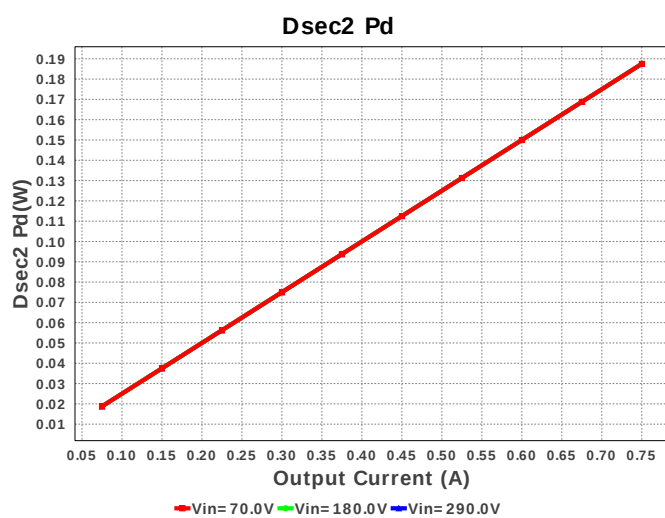
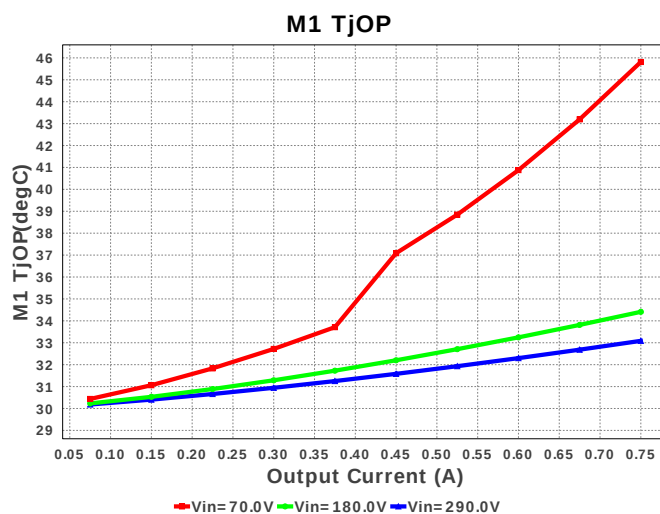
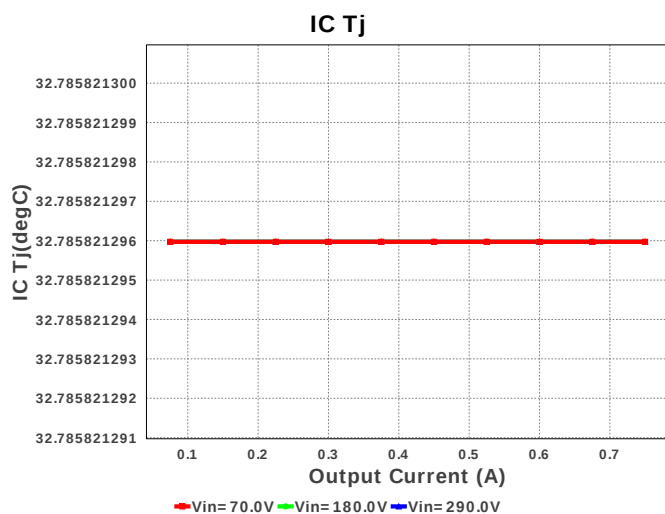
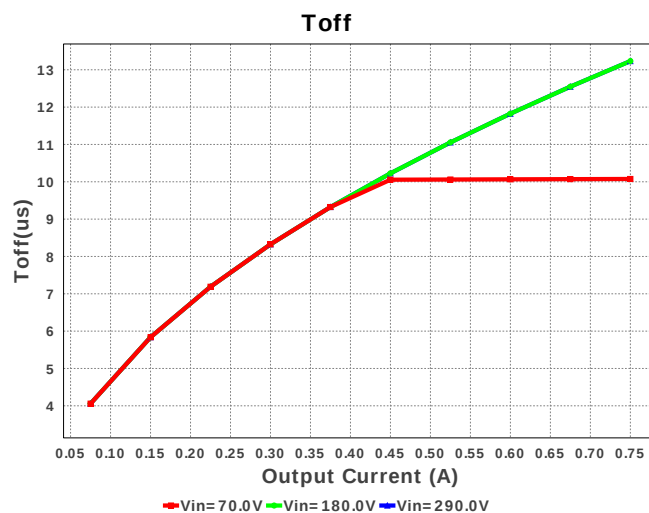
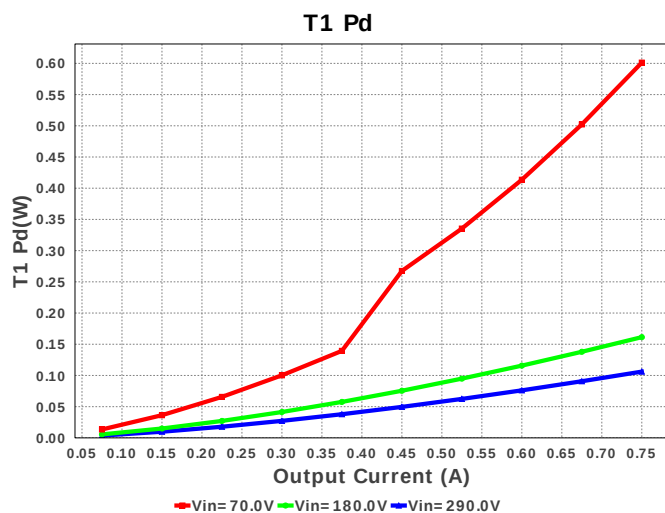
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C11	CUSTOM	CUSTOM Series= ?	Cap= 1.0 uF VDC= 615.18 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm ²
2.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	C13	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	C21	Nichicon	UUD1H151MNL1GS Series= uD	Cap= 150.0 uF ESR= 180.0 mOhm VDC= 50.0 V IRMS= 670.0 mA	1	\$0.26	 SM_RADIAL_10BMM 160 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	CC0805JRNPO9BN120 Series= C0G/NP0	Cap= 12.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²

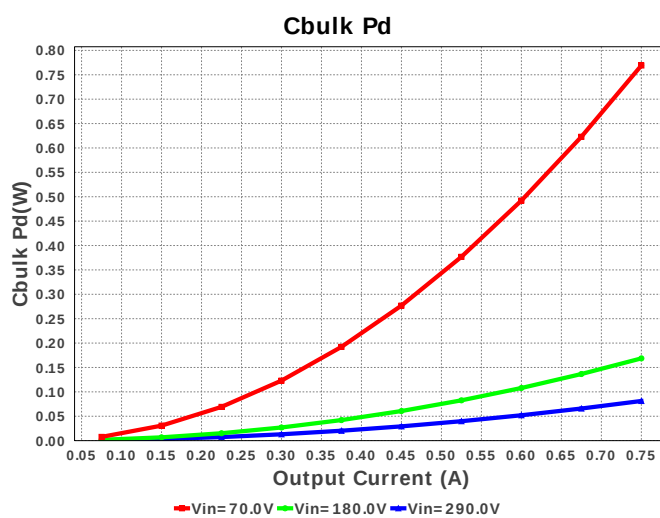
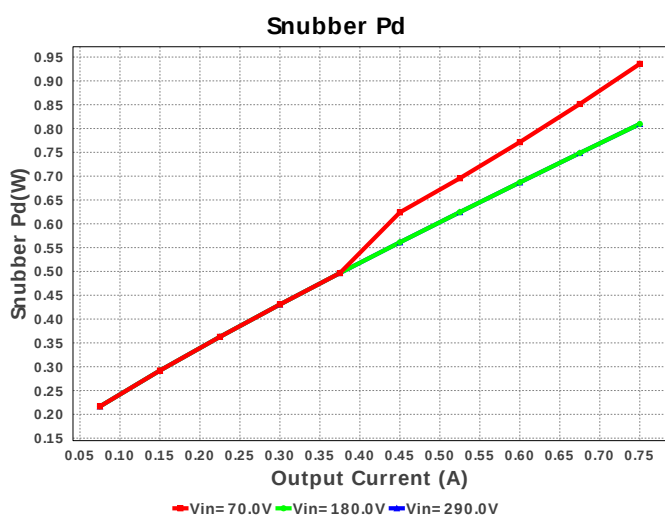
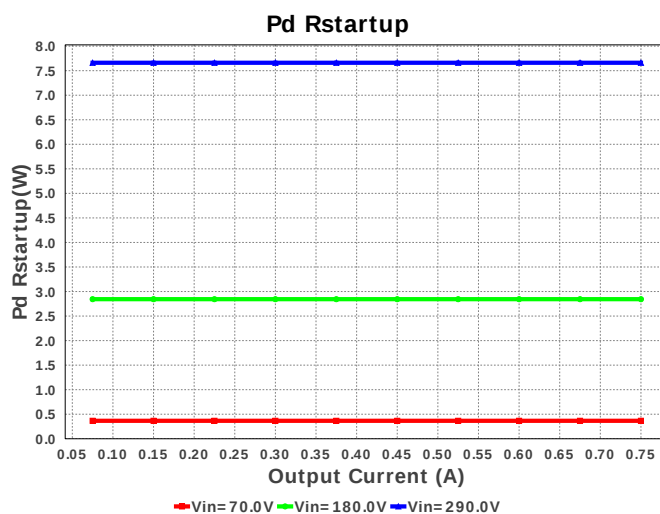
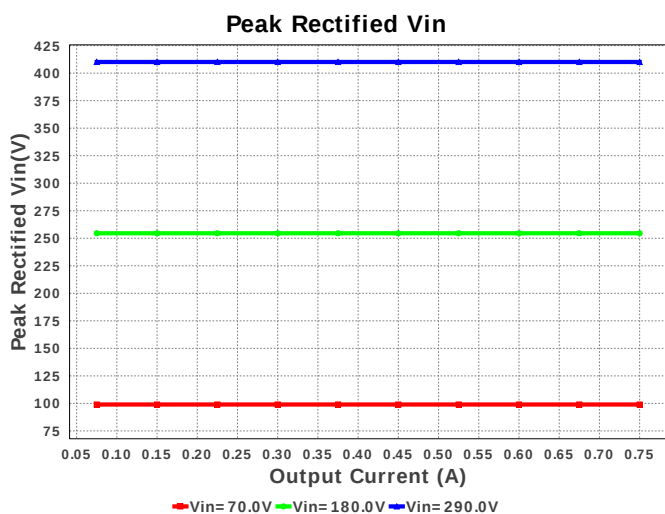
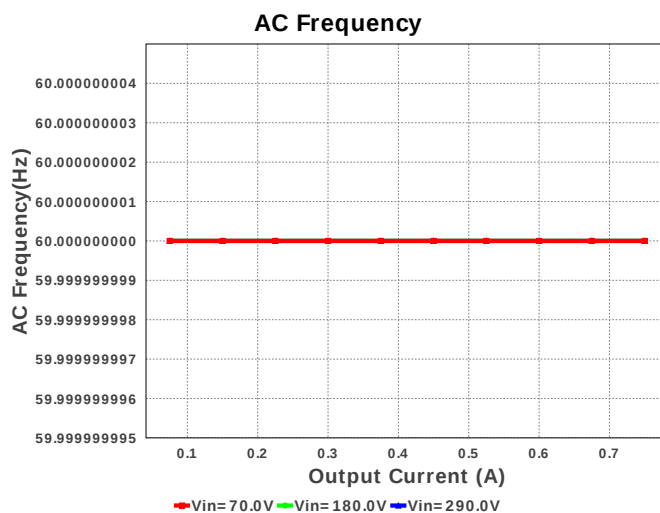
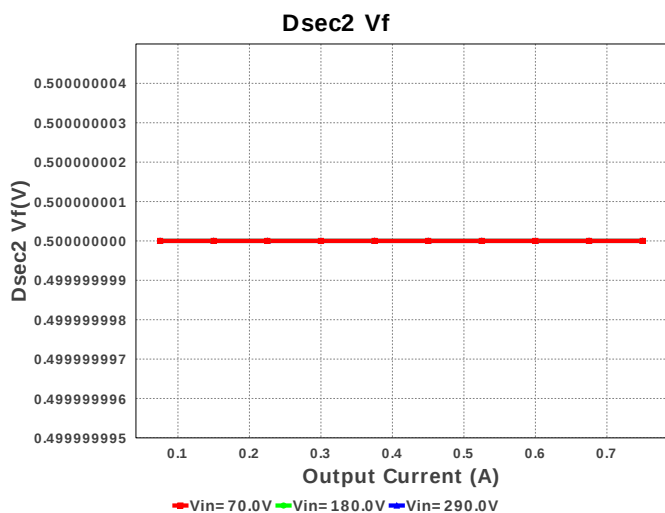
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7.	Cbulk	Vishay-Bccomponents	MAL215757121E3 Series= 2239	Cap= 120.0 uF ESR= 1.6 Ohm VDC= 450.0 V IRMS= 1.09 A	1	\$3.90	 157PUM-SI_2500x3000 729 mm ²
8.	Ccs	Samsung Electro-Mechanics	CL21C271JBANFNC Series= C0G/NP0	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
9.	Cout1	Panasonic	EEV-FK1K331M Series= FK	Cap= 330.0 uF ESR= 170.0 mOhm VDC= 80.0 V IRMS= 793.0 mA	1	\$0.78	 SM_RADIAL_J16 399 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.	Csnub	AVX	12061C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 37.0 mOhm VDC= 100.0 V IRMS= 0.0 A	1	\$0.03	 1206 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	\$0.01	 0805 7 mm ²
13.	Cvcc	Nichicon	UUD1E101MCL1GS Series= uD	Cap= 100.0 uF ESR= 340.0 mOhm VDC= 25.0 V IRMS= 280.0 mA	1	\$0.12	 SM_RADIAL_6.3BMM 80 mm ²
14.	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
15.	Cy1	CUSTOM	CUSTOM Series= ?	Cap= 762.62 pF ESR= 1.0 mOhm VDC= 492.14 V IRMS= 500.0 uA	1	NA	CUSTOM 0 mm ²
16.	Cy2	CUSTOM	CUSTOM Series= ?	Cap= 762.62 pF ESR= 1.0 mOhm VDC= 492.14 V IRMS= 500.0 uA	1	NA	CUSTOM 0 mm ²
17.	Cy3	CUSTOM	CUSTOM Series= ?	Cap= 762.62 pF ESR= 1.0 mOhm VDC= 492.14 V IRMS= 500.0 uA	1	NA	CUSTOM 0 mm ²
18.	D21	Diodes Inc.	B160-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.05	 SMA 37 mm ²
19.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	\$0.24	 DF-S 99 mm ²

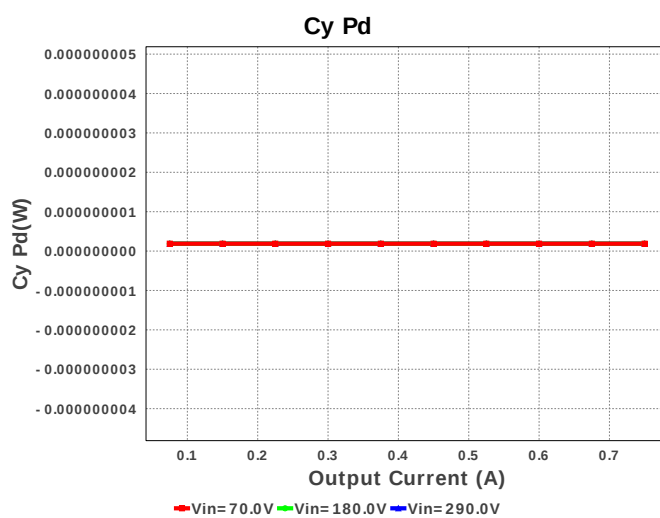
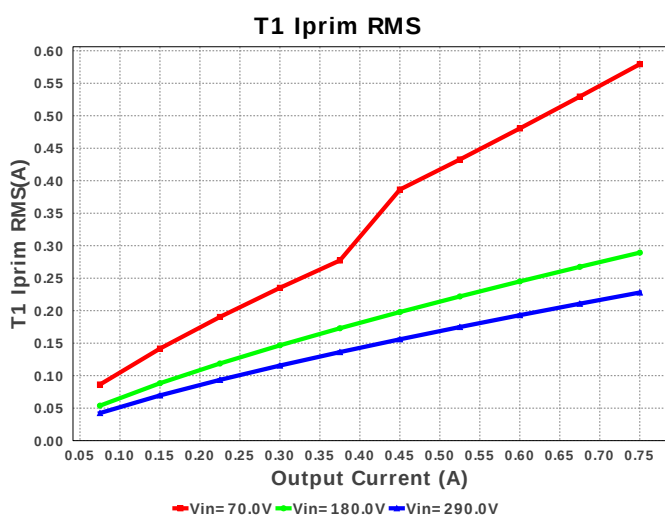
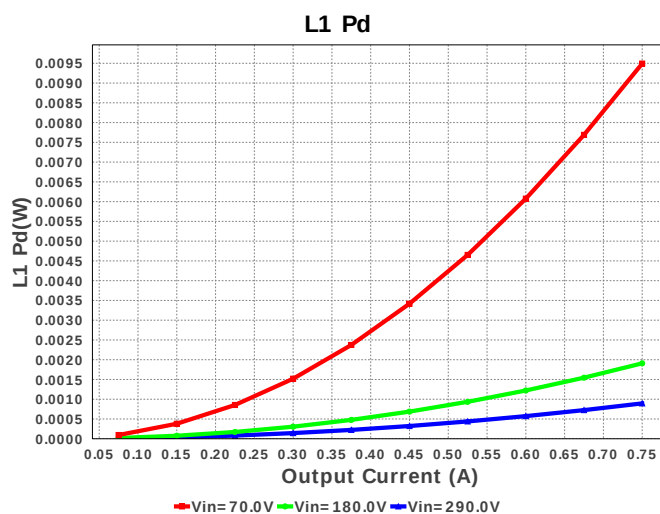
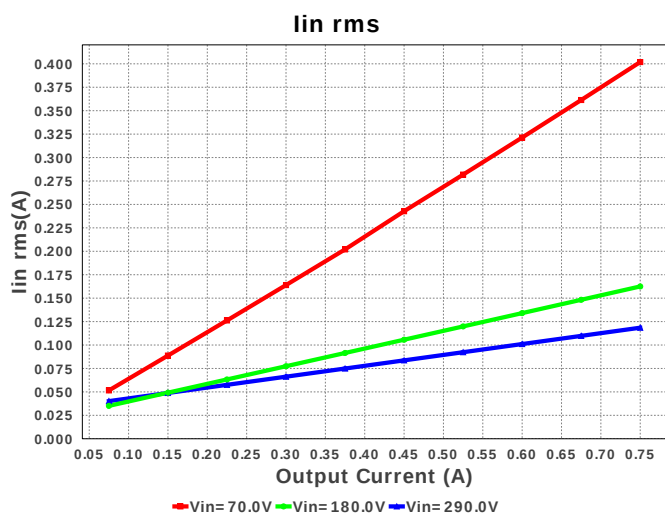
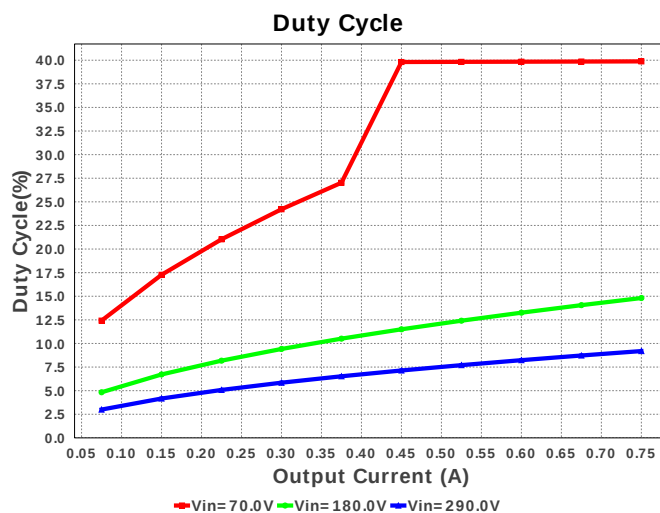
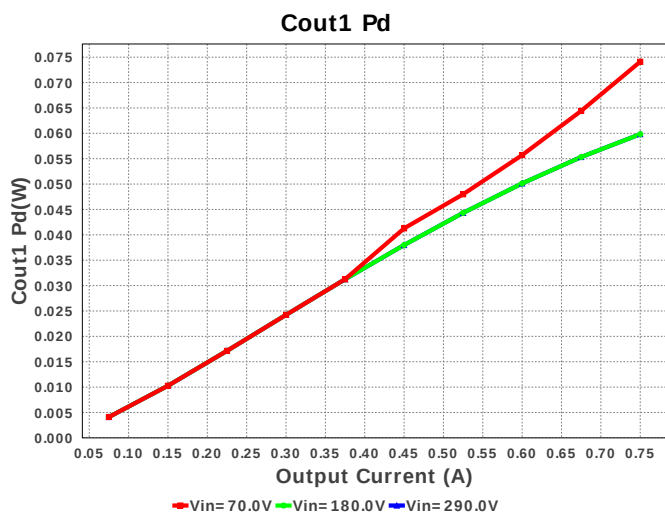
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20.	Daux	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 282.487 V	1	NA	CUSTOM 0 mm ²
21.	Dsec	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 809.973 V	1	NA	CUSTOM 0 mm ²
22.	Dsec2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 809.973 V	1	NA	CUSTOM 0 mm ²
23.	Dsnub	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 589.225 V	1	NA	CUSTOM 0 mm ²
24.	Dz	Diodes Inc.	MMSZ5250B-7-F	Zener	1	\$0.03	 SOD-123 13 mm ²
25.	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	\$6.32	 CM6296 833 mm ²
26.	M1	STMicroelectronics	STF10N80K5	VdsMax= 800.0 V IdsMax= 9.0 Amps	1	\$2.52	 TO-220FP 79 mm ²
27.	O1	Vishay-Semiconductor	TCMT1107	Optocoupler	1	\$0.21	 SOP-4 44 mm ²
28.	Q1	ON Semiconductor	BC846BLT1G	Bipolar Transistor	1	\$0.02	 SOT-23 14 mm ²
29.	Qsc	STMicroelectronics	2N2222A	Bipolar Transistor	1	NA	 TO-18 57 mm ²
30.	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
31.	R12	Vishay-Dale	CRCW040228K0FKED Series= CRCW..e3	Res= 28.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
32.	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
33.	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
34.	R22	Vishay-Dale	CRCW04022M26FKED Series= CRCW..e3	Res= 2.26 MOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
35.	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
36.	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
37.	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
38.	Rdrv	Vishay-Dale	CRCW04024R53FKED Series= CRCW..e3	Res= 4.53 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

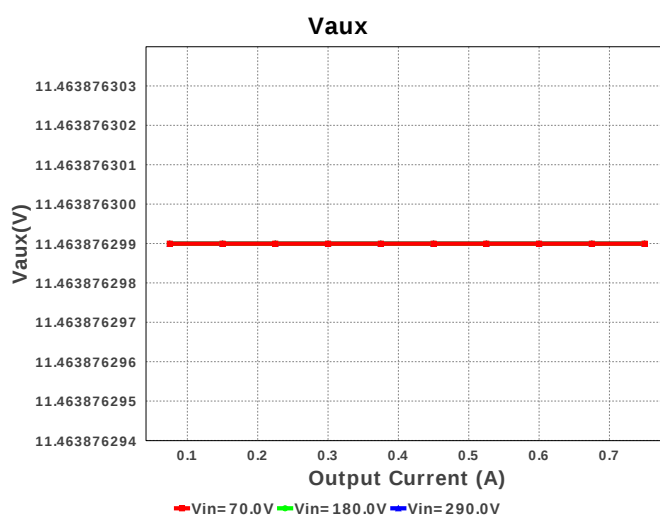
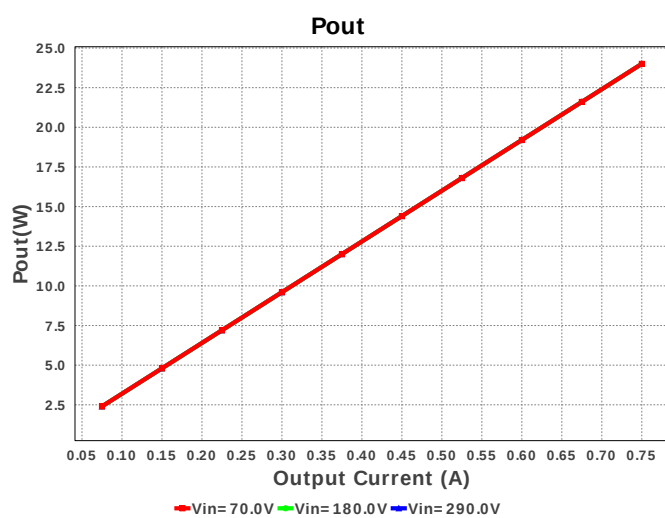
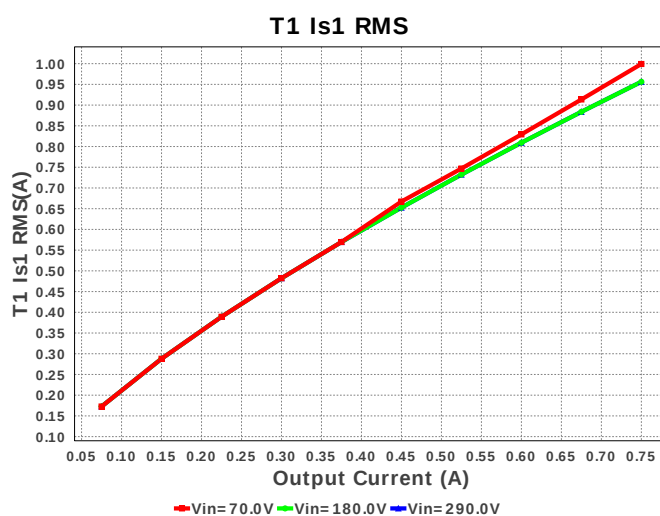
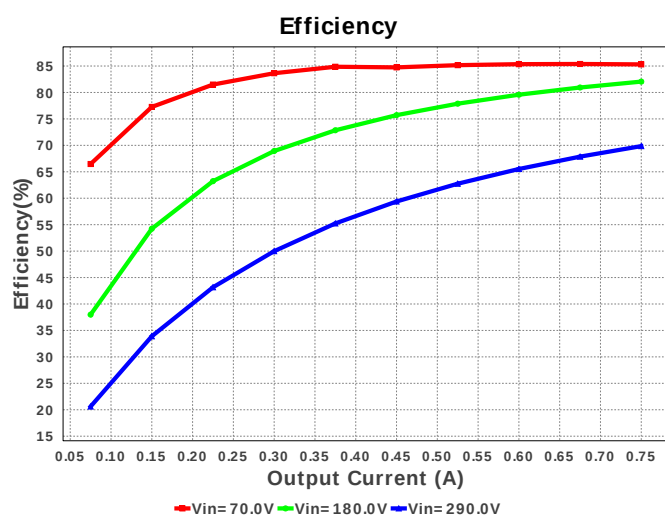
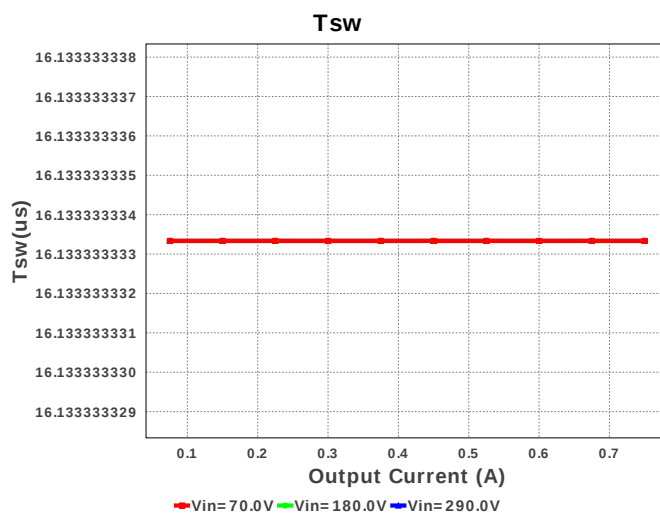
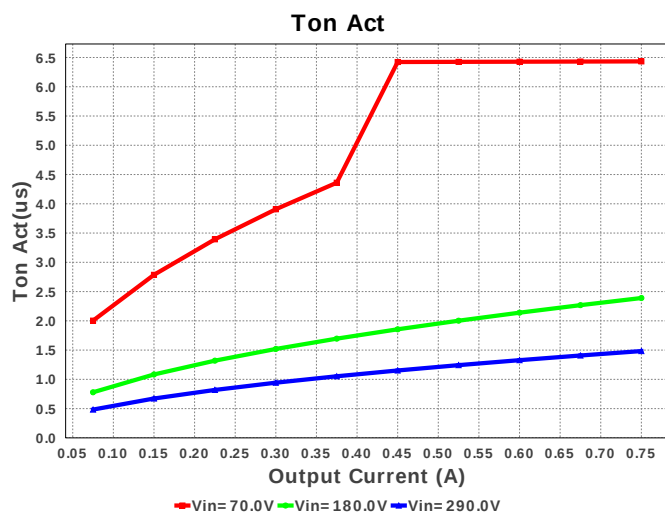
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40.	Rfbt	Vishay-Dale	CRCW040232K4FKED Series= CRCW..e3	Res= 32.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
41.	Rled	Vishay-Dale	CRCW040231K6FKED Series= CRCW..e3	Res= 31.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
42.	Rsc	Vishay-Dale	CRCW04028K87FKED Series= CRCW..e3	Res= 8.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
43.	Rsns	Bourns	CRM1206-FX-R510ELF Series= ?	Res= 510.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.03	 1206 11 mm²
44.	Rsnsb1	Vishay-Bccomponents	PR02000208201JR500 Series= ?	Res= 8.2 kOhm Power= 2.0 W Tolerance= 5.0%	1	\$0.05	 PR02 113 mm²
45.	Rsnsb2	Vishay-Bccomponents	PR02000208201JR500 Series= ?	Res= 8.2 kOhm Power= 2.0 W Tolerance= 5.0%	1	\$0.05	 PR02 113 mm²
46.	Rstartup1	CUSTOM	CUSTOM Series= ?	Res= 41.383 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm²
47.	Rstartup2	CUSTOM	CUSTOM Series= ?	Res= 41.383 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm²
48.	Rt	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
49.	Rx1	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm²
50.	Rx2	Vishay-Semiconductor	CRCW2010200KFKEF Series= ?	Res= 200.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm²
51.	Rz	Panasonic	ERJ-8ENF6651V Series= ERJ-8E	Res= 6.65 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
52.	T1	CUSTOM	CUSTOM	Lp= 467.175 µH Rp= 870.0 mOhm Leakage_L= 9.343 µH Ns1toNp= 0.712 Rs1= 8.6 mOhms Ns2toNp= 0.251 Rs2= 700.0 µOhms	1	NA	CUSTOM 0 mm²
53.	U1	Texas Instruments	UCC3813DTR-1	Switcher	1	\$0.99	 D0008A 57 mm²
54.	VR	Texas Instruments	TL431AIDBZR	Voltage References	1	\$0.08	 DBZ0003A 14 mm²

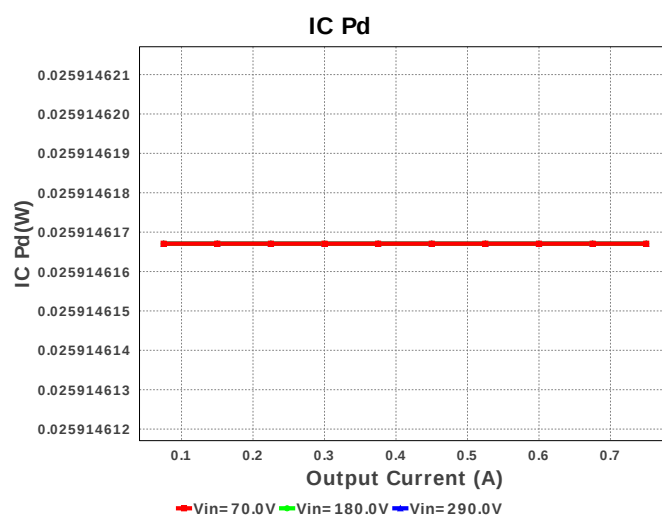
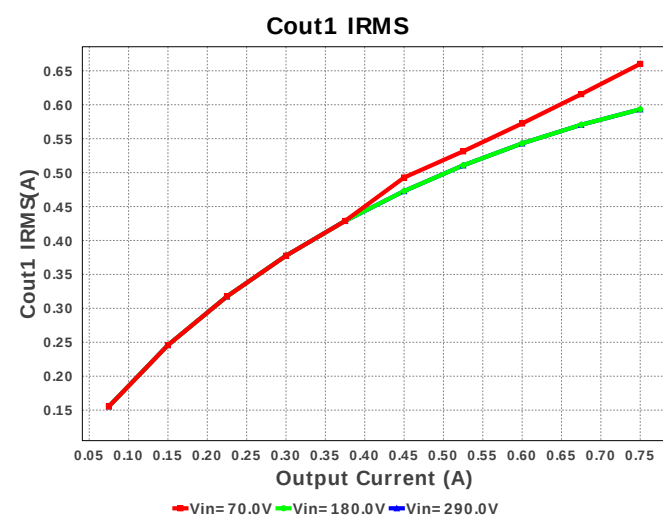
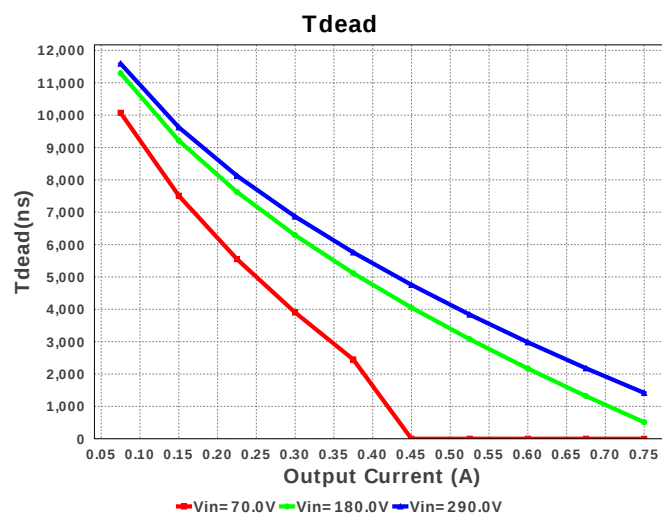
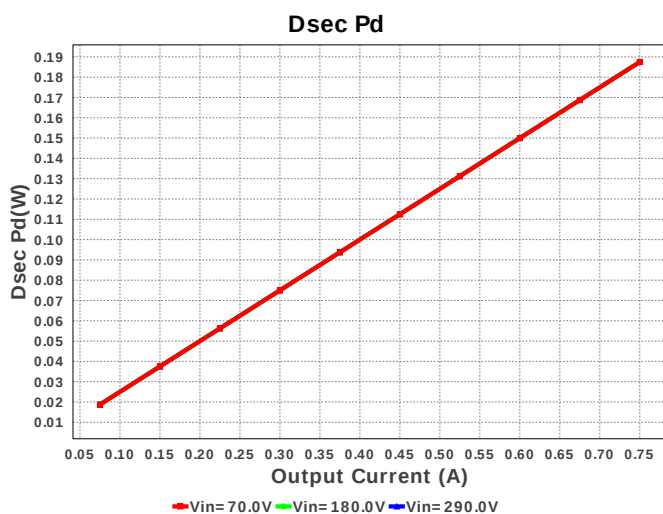
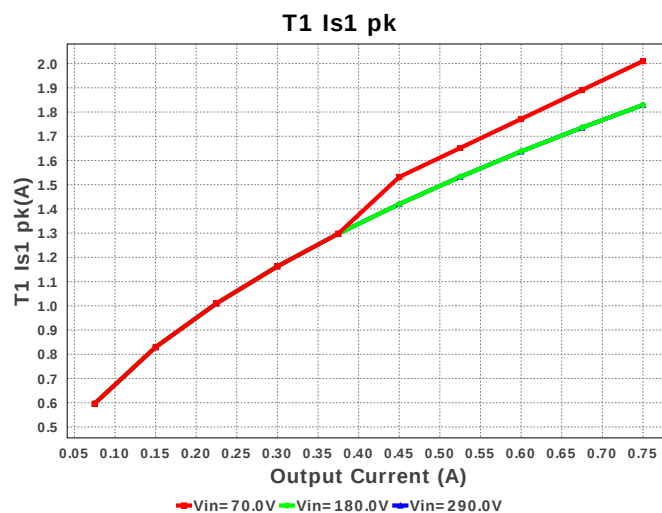
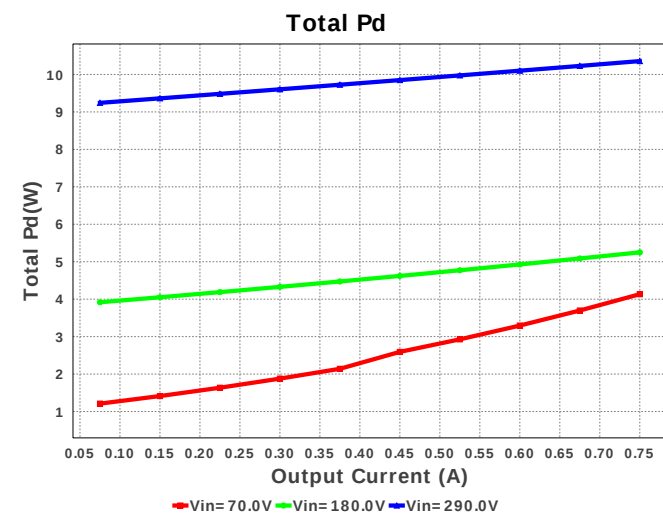


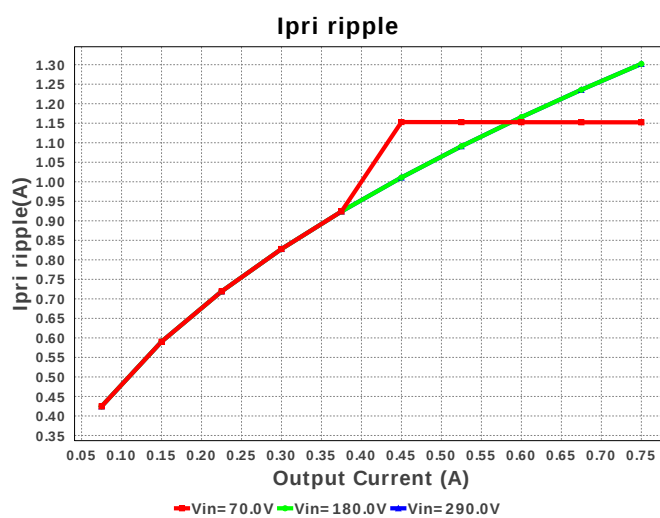
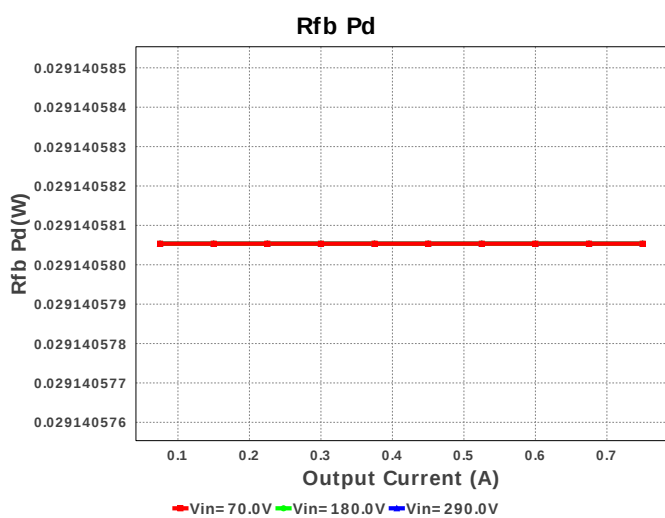
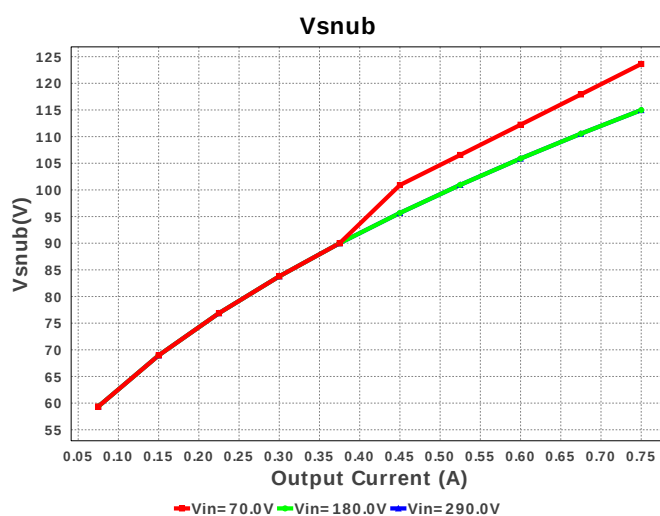
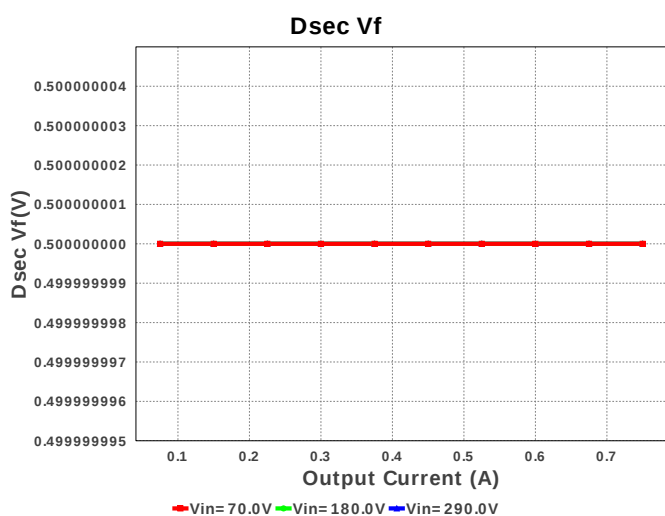
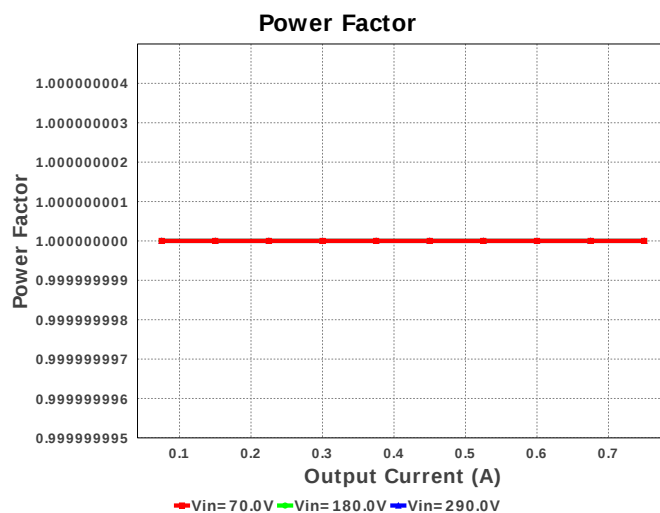
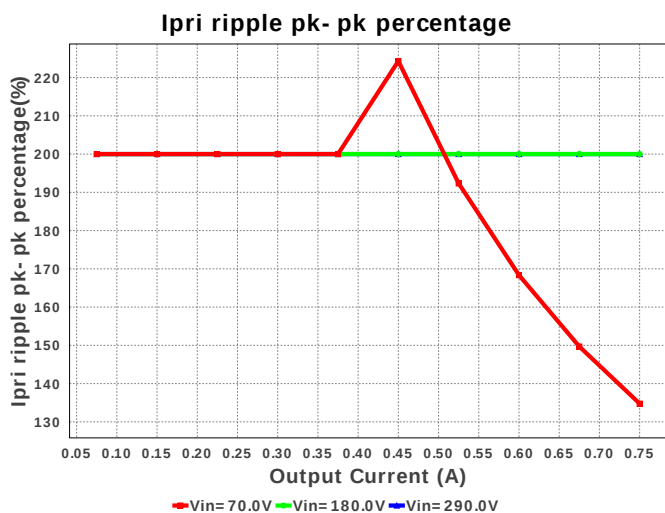


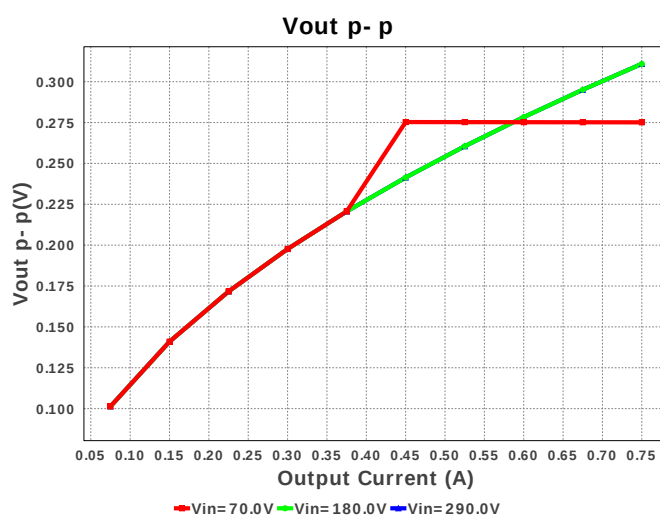
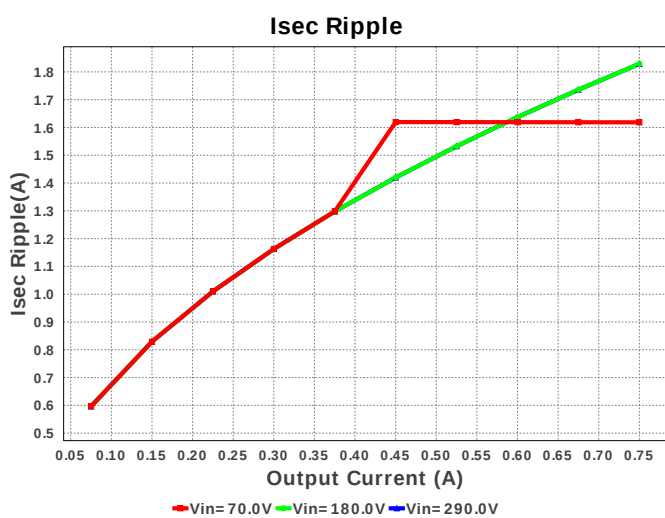
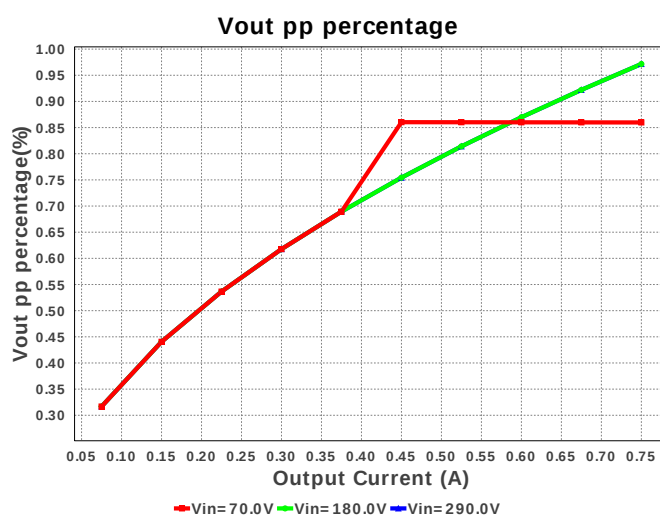
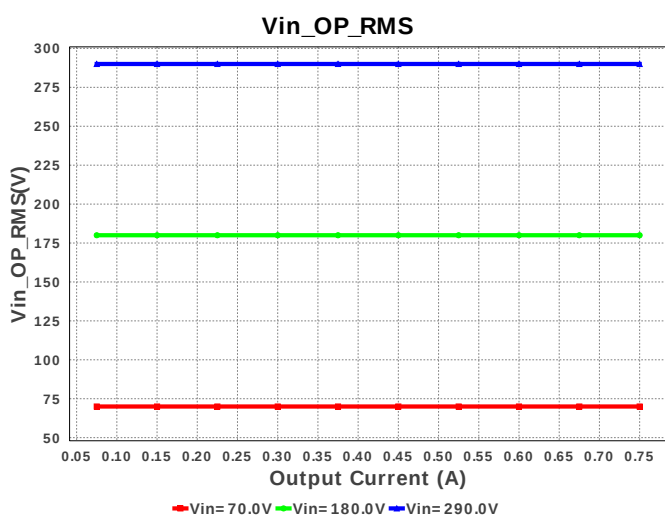
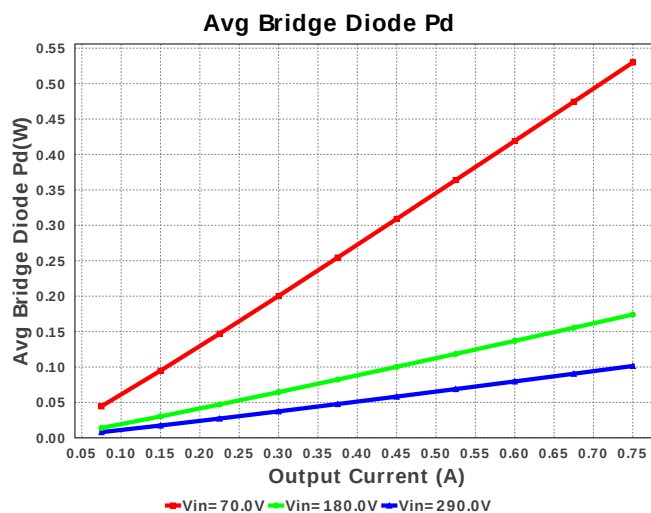
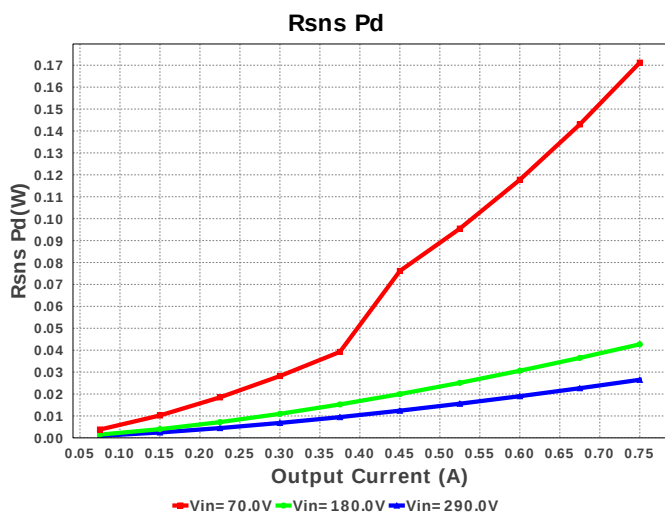


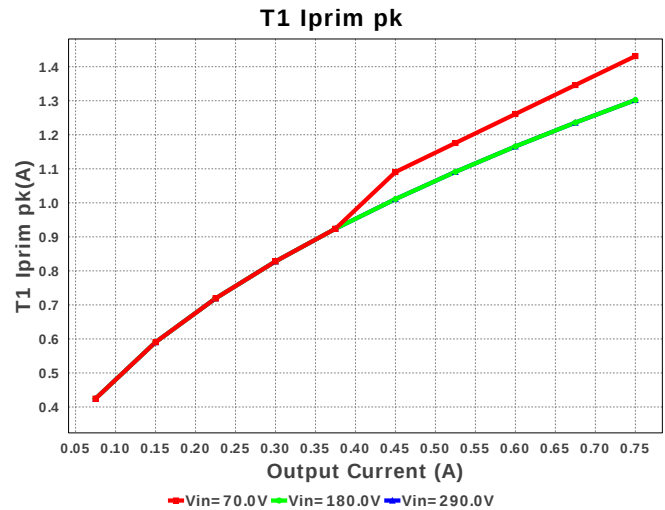
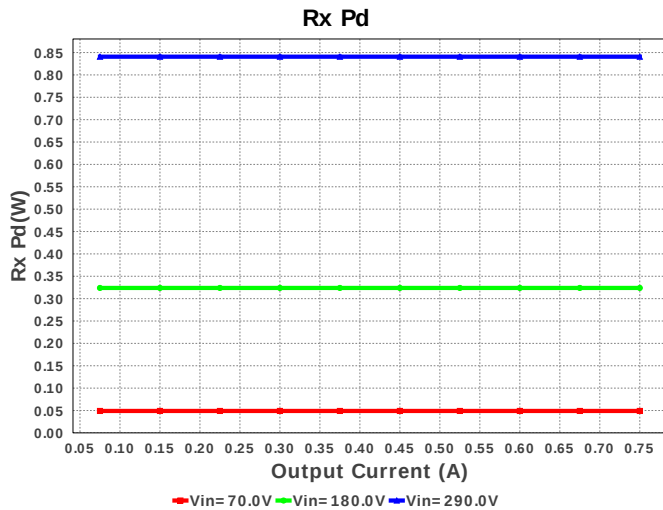












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	660.213 mA	Current	Output capacitor1 RMS ripple current
2.	Iin rms	401.89 mA	Current	RMS Input Current
3.	Iout_DCM	412.02 mA	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	340.959 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	1.152 A	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	134.764 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	1.618 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	579.355 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	1.431 A	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	999.191 mA	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	2.01 A	Current	Transformer Secondary1 Peak Current
12.	AC Frequency	60.0 Hz	General	Input AC frequency
13.	BOM Count	54	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	0.0 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	0.0 ns	General	Snubber Diode Reverse Recovery Time
19.	FootPrint	3.313 k mm ²	General	Total Foot Print Area of BOM components
20.	Frequency	61.983 kHz	General	Switching frequency
21.	Mode	CCM	General	Conduction Mode
22.	Pout	24.0 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	10.075 us	General	Approximate Converter Off Time
26.	Ton Act	6.433 us	General	Approximate Converter On Time
27.	Total BOM	\$0.0	General	Total BOM Cost
28.	Tsw	16.133 us	General	Switching Time Period
29.	Vaux	11.464 V	General	Auxiliary Voltage
30.	Vsnub	123.627 V	General	Voltage Across the Snubber
31.	Vout Actual	31.998 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
32.	Vout OP	32.0 V	Op_Point	Operational Output Voltage
33.	Duty Cycle	39.877 %	Op_point	Duty cycle
34.	Efficiency	85.31 %	Op_point	Steady state efficiency
35.	IC Tj	32.786 degC	Op_point	IC junction temperature
36.	ICThetaJA	107.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
37.	IOUT_OP	750.0 mA	Op_point	Iout operating point
38.	M1 TJOP	45.812 degC	Op_point	M1 MOSFET junction temperature
39.	Peak Rectified Vin	98.994 V	Op_point	Peak voltage seen at rectified input
40.	Vin_OP_RMS	70.0 V	Op_point	AC Input RMS Voltage
41.	Vout p-p	275.137 mV	Op_point	Peak-to-peak output ripple voltage
42.	Avg Bridge Diode Pd	529.861 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
43.	Cbulk Pd	769.065 mW	Power	Bulk capacitor power dissipation
44.	Cout1 Pd	74.1 mW	Power	Output capacitor1 power dissipation
45.	Cx Pd	0.0 W	Power	X-cap Power Dissipation
46.	Cy Pd	187.5 pW	Power	Y-caps Power Dissipation
47.	Dsec Pd	187.5 mW	Power	Secondary Diode Power Dissipation
48.	Dsec2 Pd	187.5 mW	Power	Secondary Diode Power Dissipation
49.	IC Pd	25.915 mW	Power	IC power dissipation
50.	L1 Pd	9.492 mW	Power	Power Dissipation in the Inductor

#	Name	Value	Category	Description
51.	M1 Pd	252.998 mW	Power	M1 MOSFET total power dissipation
52.	Paux	11.471 mW	Power	Power Dissipation in Raux and Daux
53.	Pd Rstartup	366.055 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
54.	Rdrv Pd	8.424 μ W	Power	Power Dissipation in Gate Drive Resistor
55.	Rfb Pd	29.141 mW	Power	Rfb Power Dissipation
56.	Rsns Pd	171.183 mW	Power	Current Limit Sense Resistor Power Dissipation
57.	Rx Pd	48.984 mW	Power	Total Power Dissipation in Rx1 and Rx2
58.	Snubber Pd	935.697 mW	Power	Snubber Power Dissipation
59.	T1 Pd	601.208 mW	Power	Estimated Losses in Transformer
60.	Total Pd	4.133 W	Power	Total Power Dissipation
61.	Vout Tolerance	2.189 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
62.	Vout pp percentage	859.802 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	750.0 m	Maximum Output Current
2.	VinMax	290.0	Maximum input voltage
3.	VinMin	70.0	Minimum input voltage
4.	Vout	32.0	Output Voltage
5.	line_fsw	60.0	Light Output in Lumen
6.	base_pn	UCC3813-1	Base Product Number
7.	source	AC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

1. **UCC3813-1** Product Folder : <http://www.ti.com/product/UCC3813%2D1> : contains the data sheet and other resources.

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