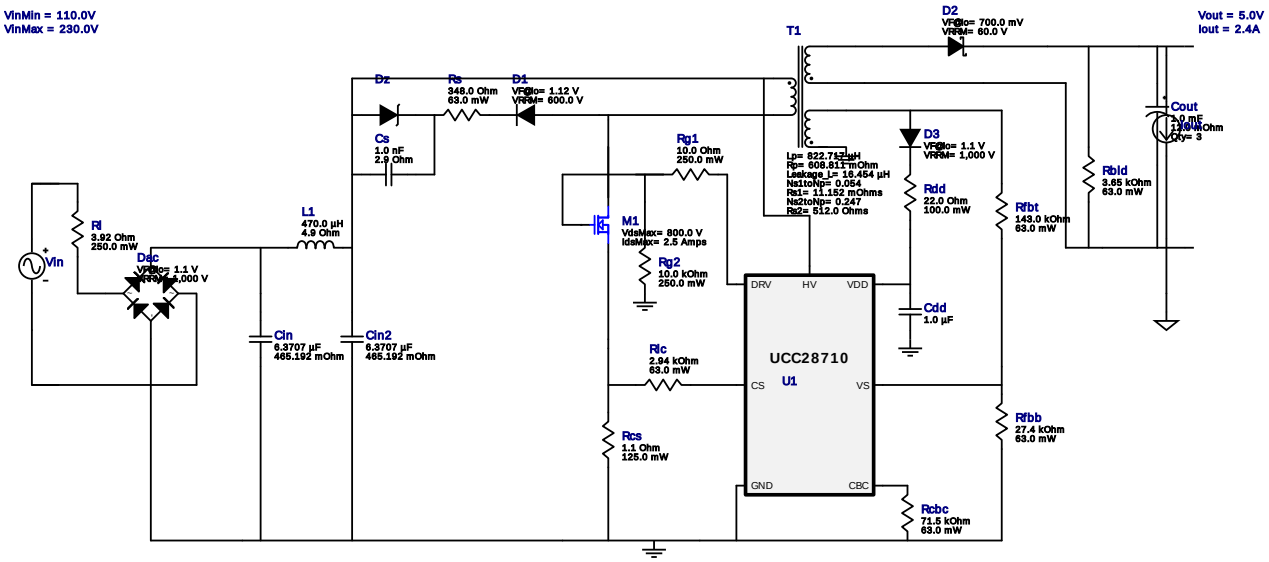
WEBENCH® Design Report

VinMin = 110.0V
VinMax = 230.0V
Vout = 5.0V
Iout = 2.4A

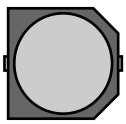
Device = UCC28710DR
Topology = Flyback
Created = 6/4/15 6:21:18 PM
BOM Cost = $0.00
Footprint = 1,123.0 mm^2
BOM Count = 27
Total Pd = 3.24W

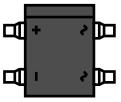
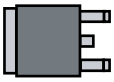
Design : 3672659/152 UCC28710DR
UCC28710DR 110.0V-230.0V to 5.63V @ 2.4A

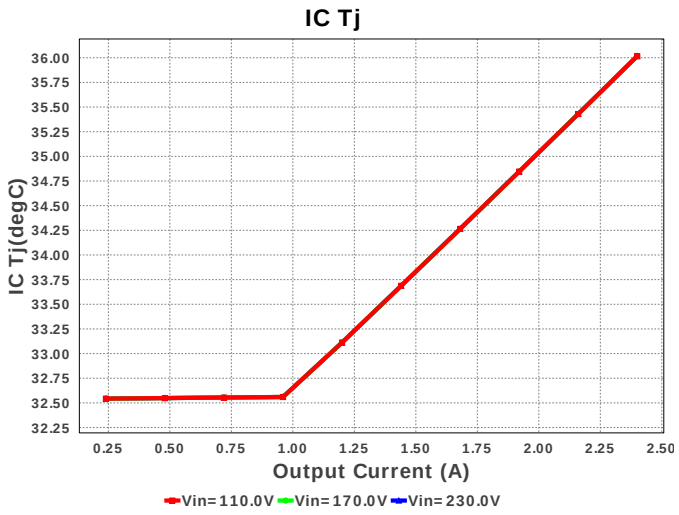


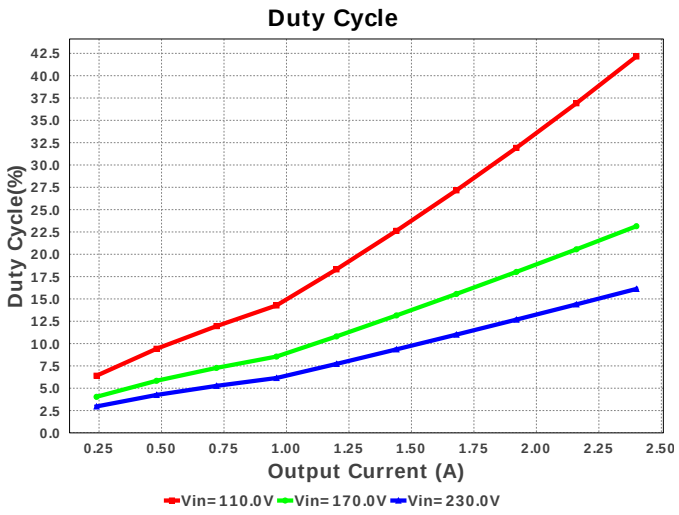
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

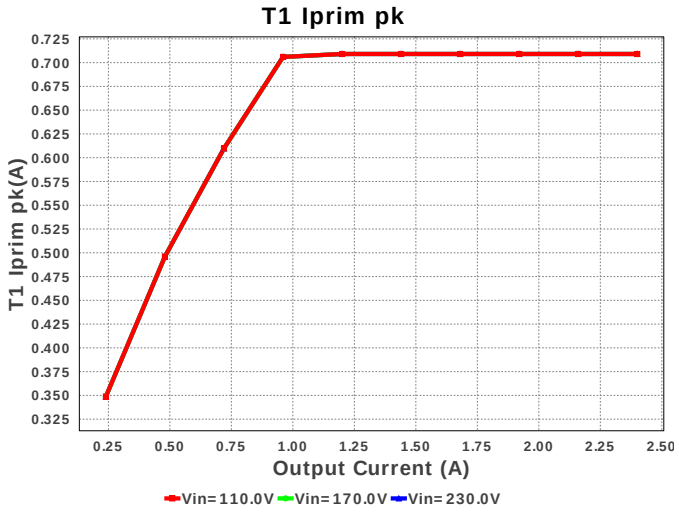
Electrical BOM

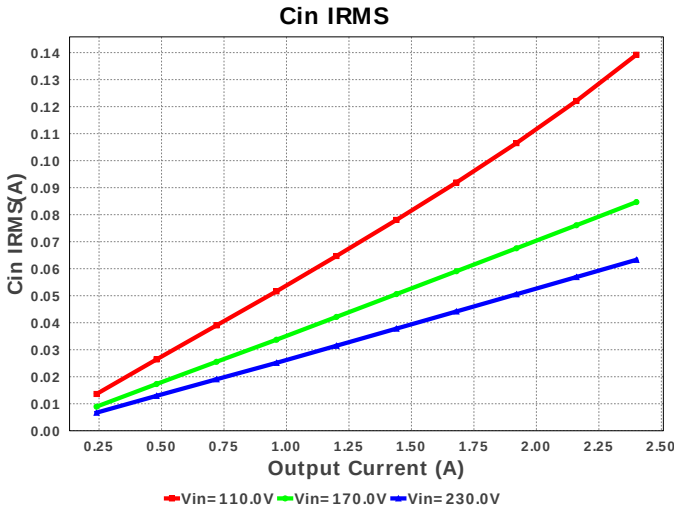
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 35.0 V IRMS= 0.0 A	1	$0.05	 0805 7 mm^2
2.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 6.3707 uF ESR= 465.19 mOhm VDC= 487.9 V IRMS= 495.61 mA	1	NA	CUSTOM 0 mm^2
3.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 6.3707 uF ESR= 465.19 mOhm VDC= 487.9 V IRMS= 495.61 mA	1	NA	CUSTOM 0 mm^2
4.	Cout	Panasonic	16SVPF1000M Series= 1273	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
5.	Cs	MuRata	GRM188R72E102KW07D Series= X7R	Cap= 1.0 nF ESR= 2.9 Ohm VDC= 250.0 V IRMS= 90.0 mA	1	$0.02	 0603 5 mm^2
6.	D1	Bourns	CD214C-F3600	VF@Io= 1.12 V VRRM= 600.0 V	1	$0.18	 SMC 83 mm^2
7.	D2	Diodes Inc.	B560C-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.19	 SMC 83 mm^2

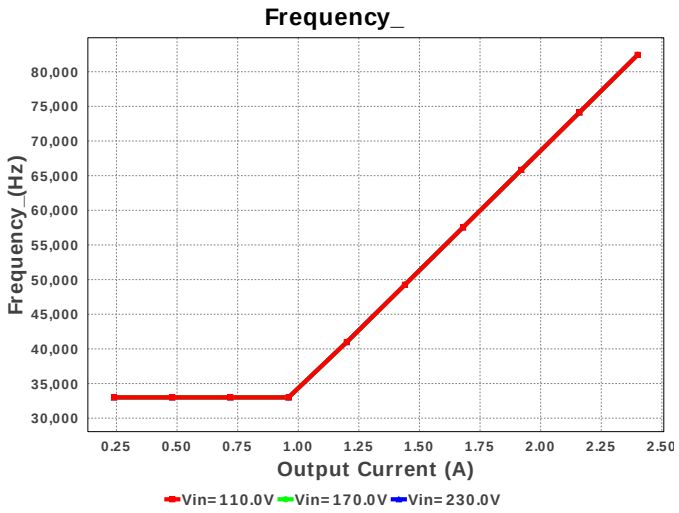
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	D3	Fairchild Semiconductor	1N4007	VF@Io= 1.1 V VRRM= 1,000.0 V	1	$0.02	 DO-41 43 mm^2
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	$0.24	 DF-S 99 mm^2
10.	Dz	ON Semiconductor	BZG03C150G	Zener	1	$0.12	 SMA 37 mm^2
11.	L1	Bourns	SDR0503-471KL	L= 470.0 µH DCR= 4.9 Ohm	1	$0.19	 SDR0503 48 mm^2
12.	M1	STMicroelectronics	STD3NK80ZT4	VdsMax= 800.0 V IdsMax= 2.5 Amps	1	$0.46	 DPAK 102 mm^2
13.	Rbld	Vishay-Dale	CRCW04023K65FKED Series= CRCW..e3	Res= 3.65 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
14.	Rcbc	Vishay-Dale	CRCW040271K5FKED Series= CRCW..e3	Res= 71.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
15.	Rcs	Vishay-Dale	CRCW08051R10FKEA Series= CRCW..e3	Res= 1.1 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
16.	Rdd	Susumu Co Ltd	RR1220Q-220-D Series= 264	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 0.5%	1	$0.01	 0805 7 mm^2
17.	Rfbb	Vishay-Dale	CRCW040227K4FKED Series= CRCW..e3	Res= 27.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Rfbt	Vishay-Dale	CRCW0402143KFKED Series= CRCW..e3	Res= 143.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
19.	Rg1	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
20.	Rg2	Panasonic	ERJ-8ENF1002V Series= ERJ-8E	Res= 10.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
21.	Rl	Vishay-Dale	CRCW12063R92FKEA Series= CRCW..e3	Res= 3.92 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
22.	Rlc	Vishay-Dale	CRCW04022K94FKED Series= CRCW..e3	Res= 2.94 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Rs	Vishay-Dale	CRCW0402348RFKED Series= CRCW..e3	Res= 348.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
24.	T1	CUSTOM	CUSTOM	Lp= 822.717 µH Rp= 608.811 mOhm Leakage_L= 16.454 µH Ns1toNp= 0.054 Rs1= 11.152 mOhms Ns2toNp= 0.247 Rs2= 512.0 Ohms	1	NA	CUSTOM 0 mm^2
25.	U1	Texas Instruments	UCC28710DR	Switcher	1	$0.42	 SOIC-7 0 mm^2

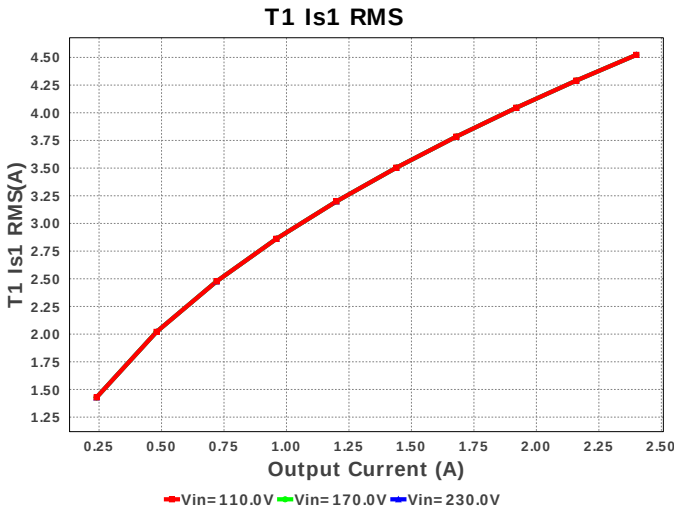


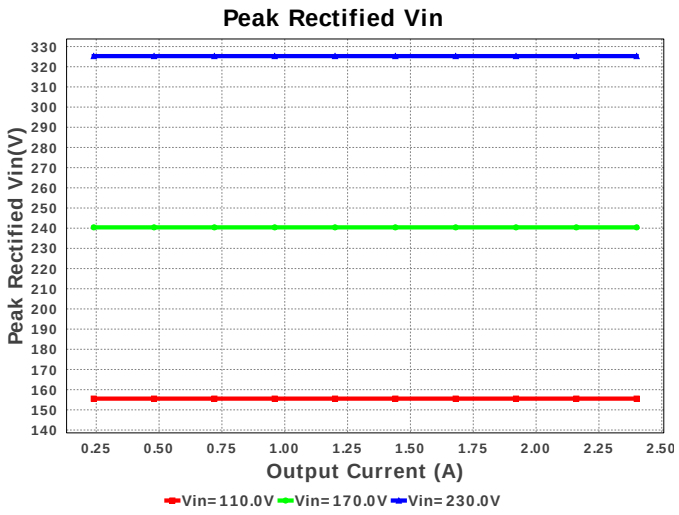


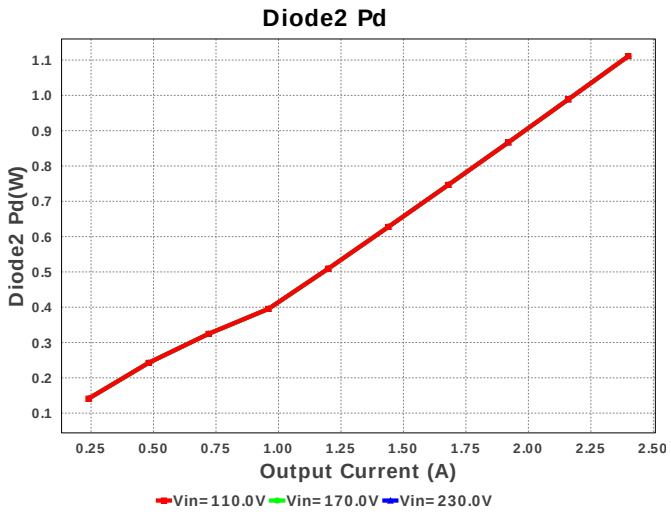


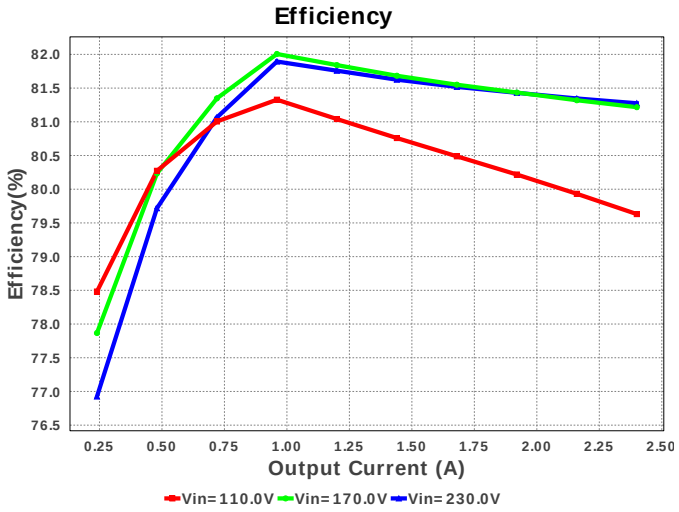


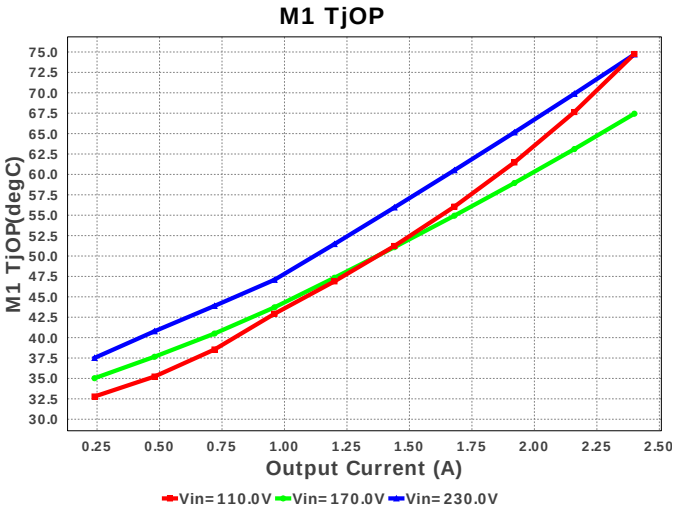


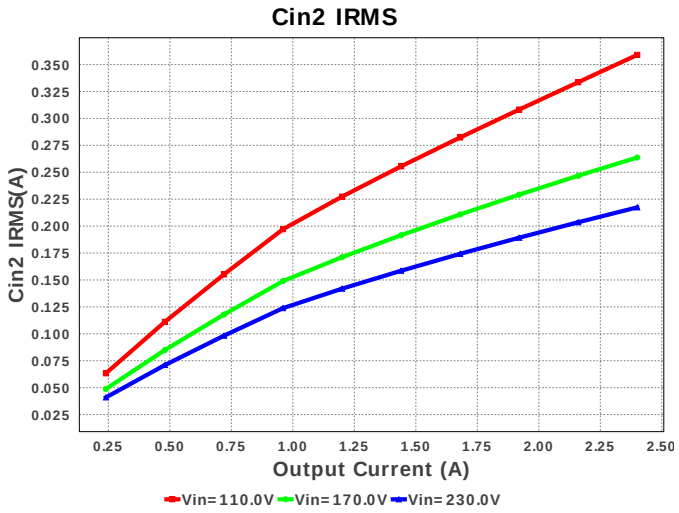


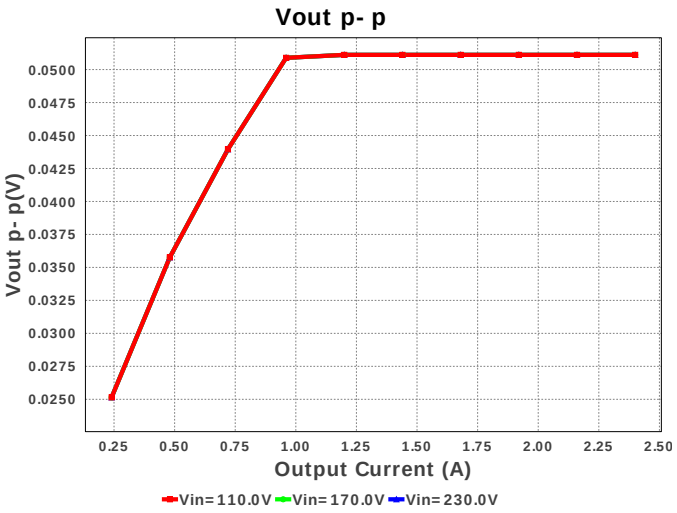


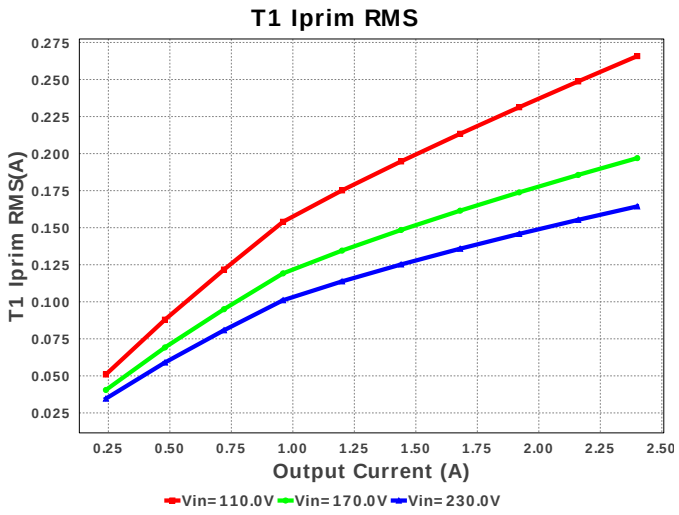


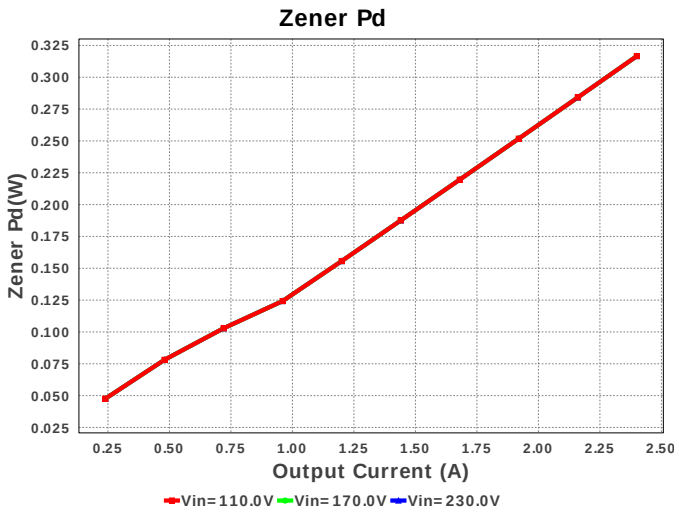


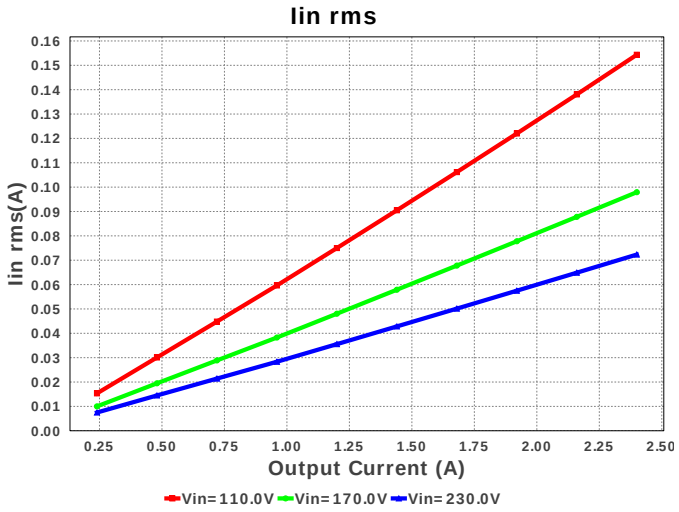


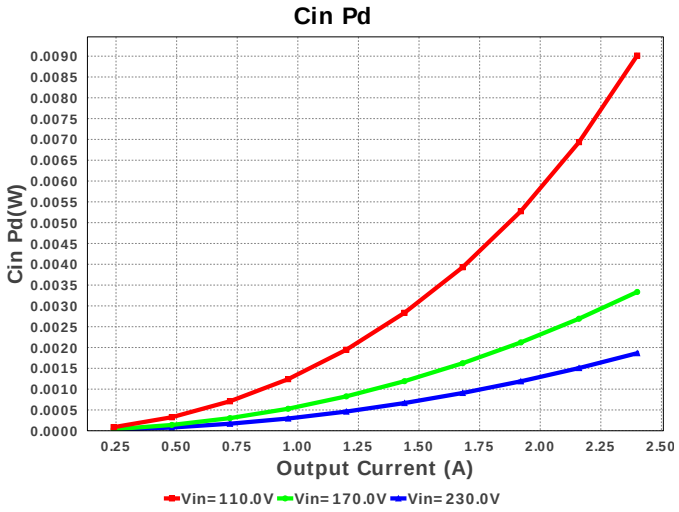


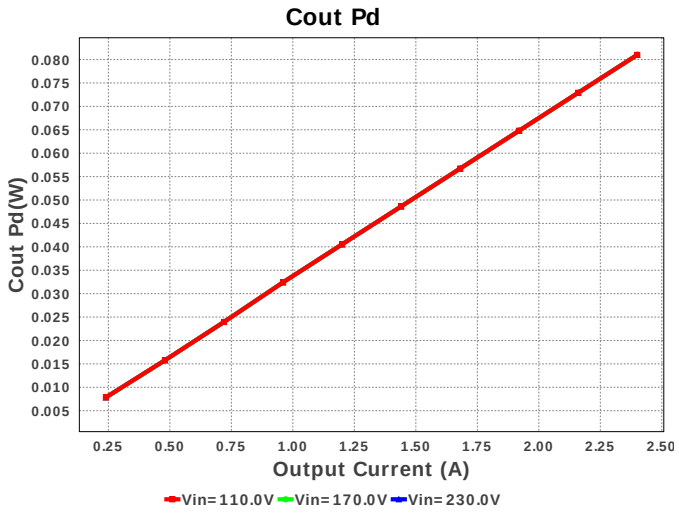


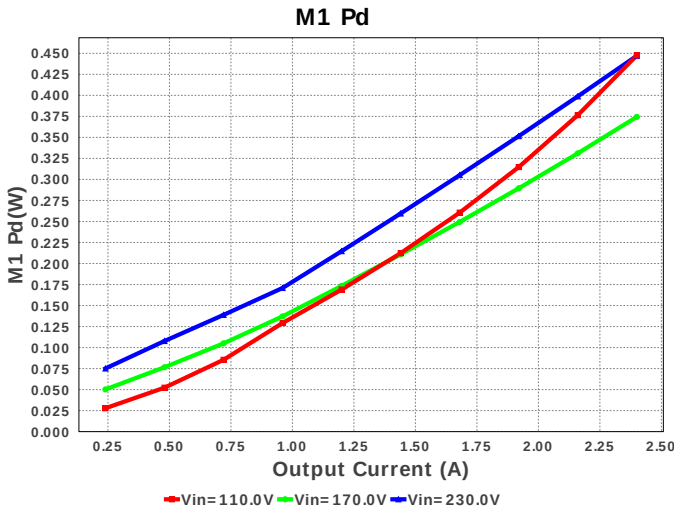


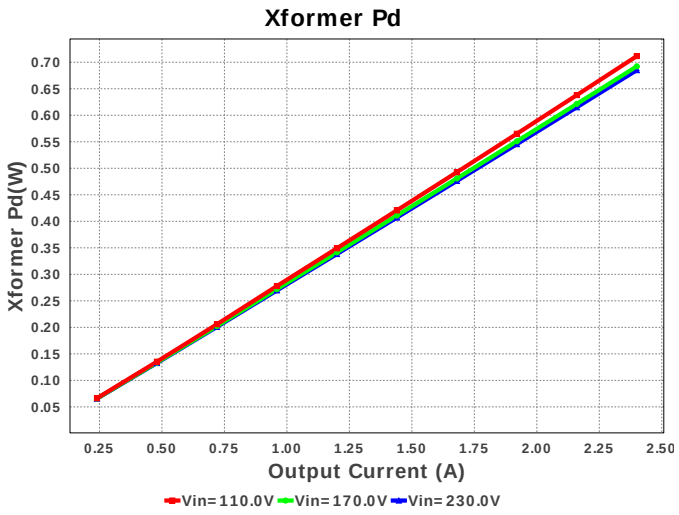


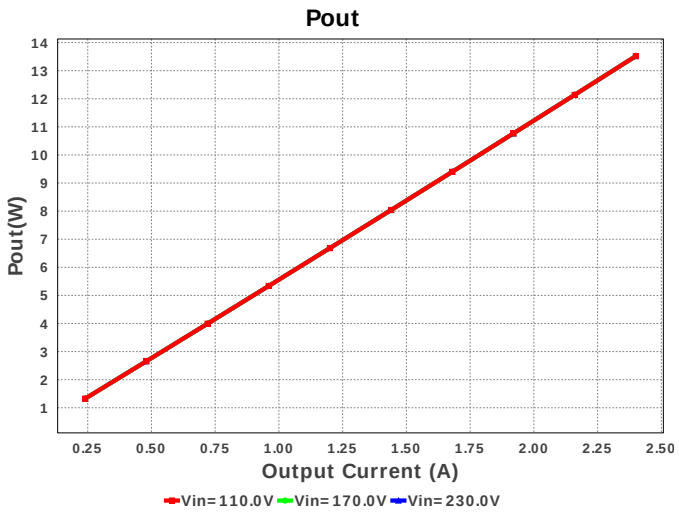


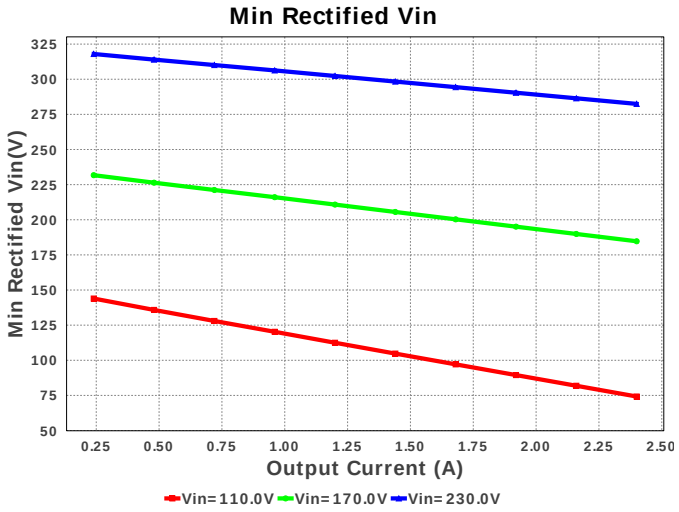


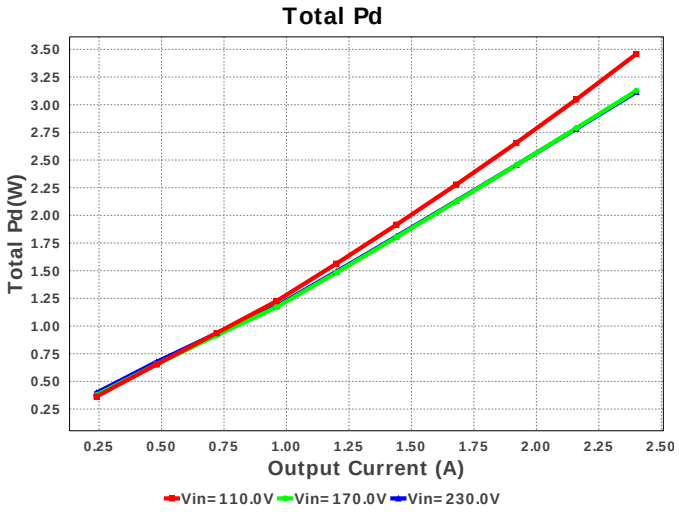


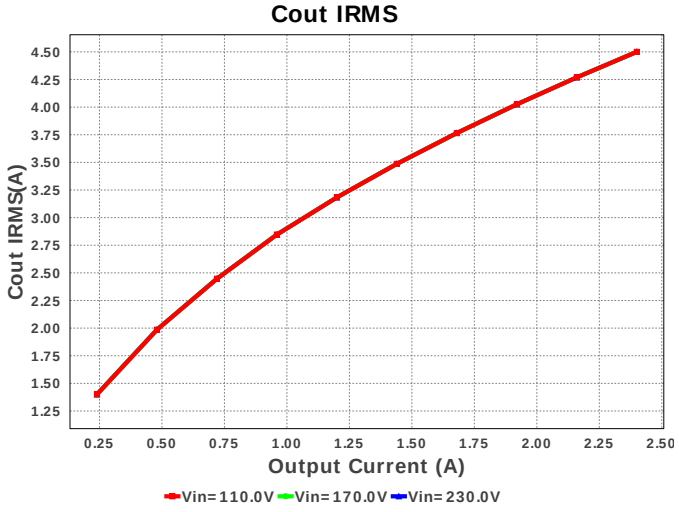


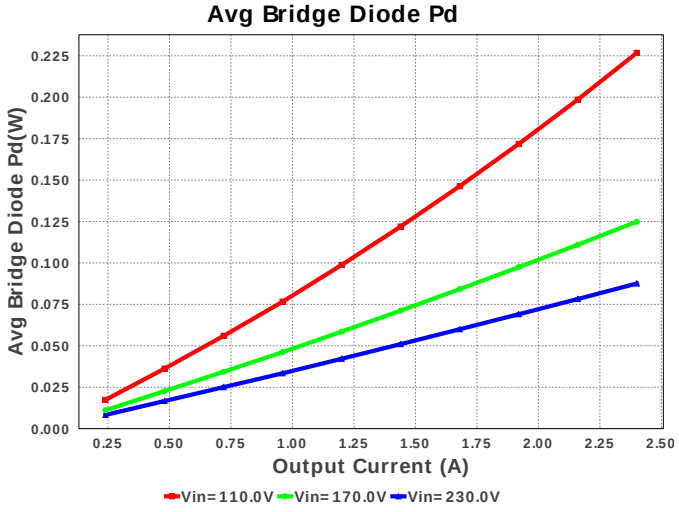


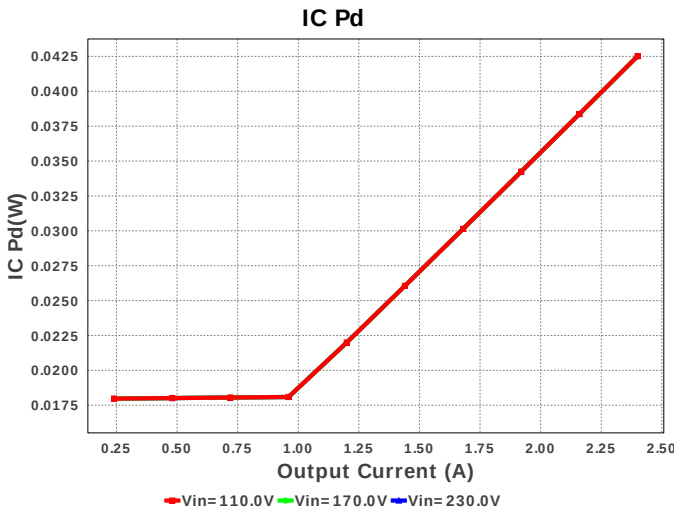


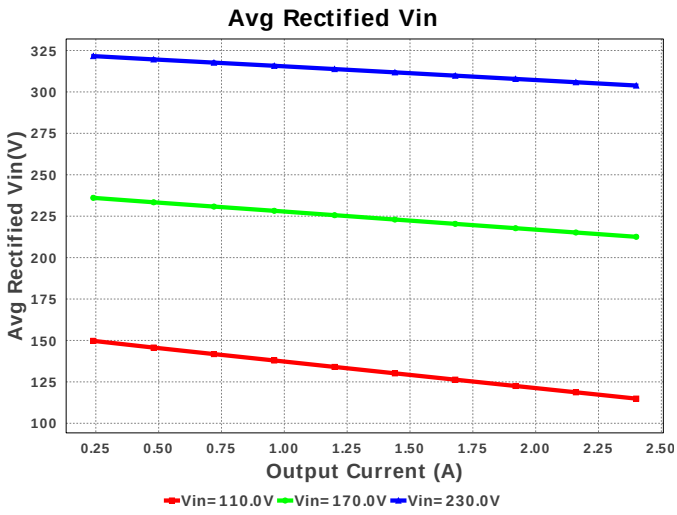


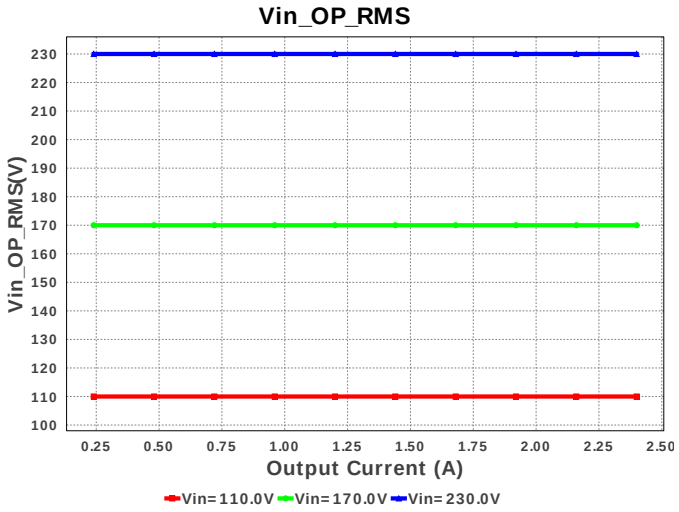


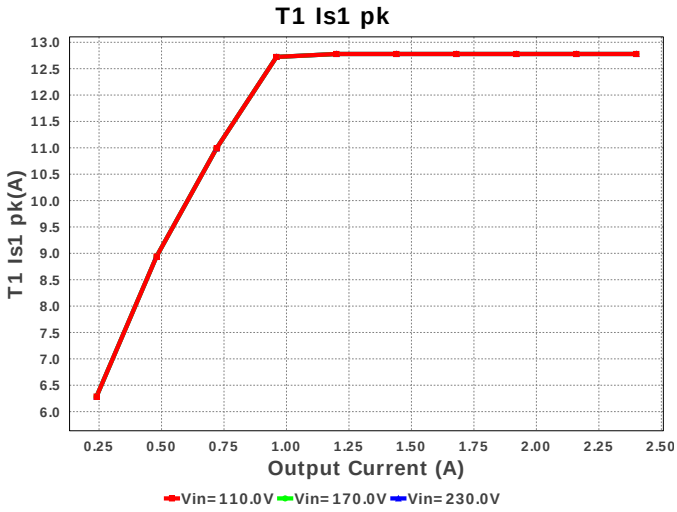


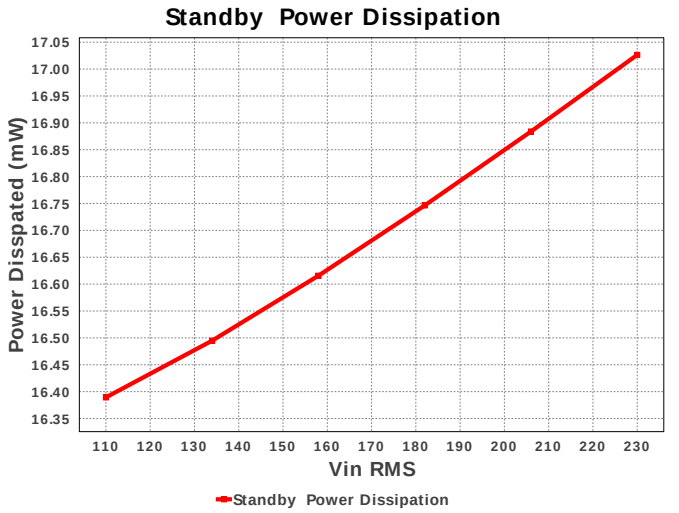


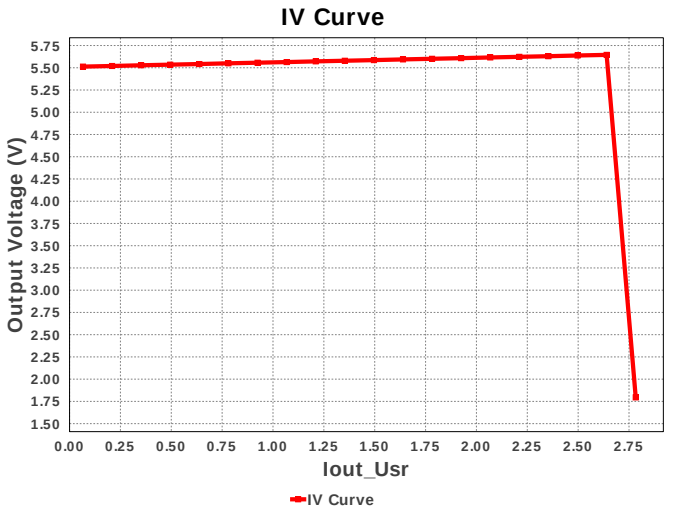












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	64.143 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	217.919 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	4.5 A	Current	Output capacitor RMS ripple current
4.	Iin rms	72.879 mA	Current	RMS Input Current
5.	T1 Iprim RMS	163.952 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	709.091 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	4.523 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	12.778 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	307.312 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	27	General	Total Design BOM count
11.	FootPrint	1.123 k mm^2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Pout	13.522 W	General	Total output power
13.	Total BOM	$0.0	General	Total BOM Cost
14.	Vout OP	5.634 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	16.038 %	Op_point	Duty cycle
16.	Efficiency	80.667 %	Op_point	Steady state efficiency
17.	Frequency_	83.032 kHz	Op_point	Switching frequency
18.	IC Tj	32.997 degC	Op_point	IC junction temperature
19.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	2.4 A	Op_point	Iout operating point
21.	M1 TjOP	75.33 degC	Op_point	M1 MOSFET junction temperature
22.	Min Rectified Vin	289.358 V	Op_point	Minimum voltage seen at rectified input
23.	Peak Rectified Vin	325.266 V	Op_point	Peak voltage seen at rectified input
24.	Vin_OP_RMS	230.0 V	Op_point	AC Input RMS Voltage
25.	Vout p-p	51.114 mV	Op_point	Peak-to-peak output ripple voltage
26.	Avg Bridge Diode Pd	79.007 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
27.	Cin Pd	1.914 mW	Power	Input capacitor power dissipation
28.	Cout Pd	81.001 mW	Power	Output capacitor power dissipation
29.	Diode2 Pd	1.217 W	Power	Diode2 power dissipation
30.	IC Pd	42.821 mW	Power	IC power dissipation
31.	M1 Pd	453.3 mW	Power	M1 MOSFET total power dissipation
32.	Total Pd	3.241 W	Power	Total Power Dissipation
33.	Xformer Pd	688.211 mW	Power	Transformer power dissipation
34.	Zener Pd	320.61 mW	Power	Zener power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	2.4	Maximum Output Current
2.	Iout1	2.4	Output Current #1
3.	VinMax	230.0	Maximum input voltage
4.	VinMin	110.0	Minimum input voltage
5.	Vout	5.0	Output Voltage
6.	Vout1	5.0	Output Voltage #1
7.	base_pn	UCC28710	Texas Instruments Base Part Number
8.	source	DC	Input Source Type
9.	ta	30.0	Ambient temperature

Design Assistance

1. Application Hints Rbld Rbld is used to to set a minimum load for the circuit, so that in standby the output voltage does not float up. The value chosen by WEBENCH should be a good starting point but may need to be adjusted to achieve minimum power dissipation at standby as well. Rlc Rlc provides the function of feed-forward line compensation to eliminate change in IPP due to change in di/dt and the propagation delay of the internal comparator and MOSFET turn-off time. For best results the chosen value may need to be adjusted based on board, FET and transformer parasitics. Rfbt & Rfbb The feedback resistors will set the output voltage of the circuit. The values chosen may need to be fined tuned based on the final Transformer turns ratios and the voltage across the output diode at close to zero current. Part Description The UCC28710 family of flyback power supply controllers provides Constant-Voltage (CV) and Constant-Current (CC) output regulation. Primary-Side Regulation (PSR) eliminates the use of an Opto-Coupler. Please see the datasheet for further design guidance. http://www.ti.com/lit/ds/symlink/ucc28710.pdf

2. UCC28710 Product Folder : http://www.ti.com/product/UCC28710 : contains the data sheet and other resources.