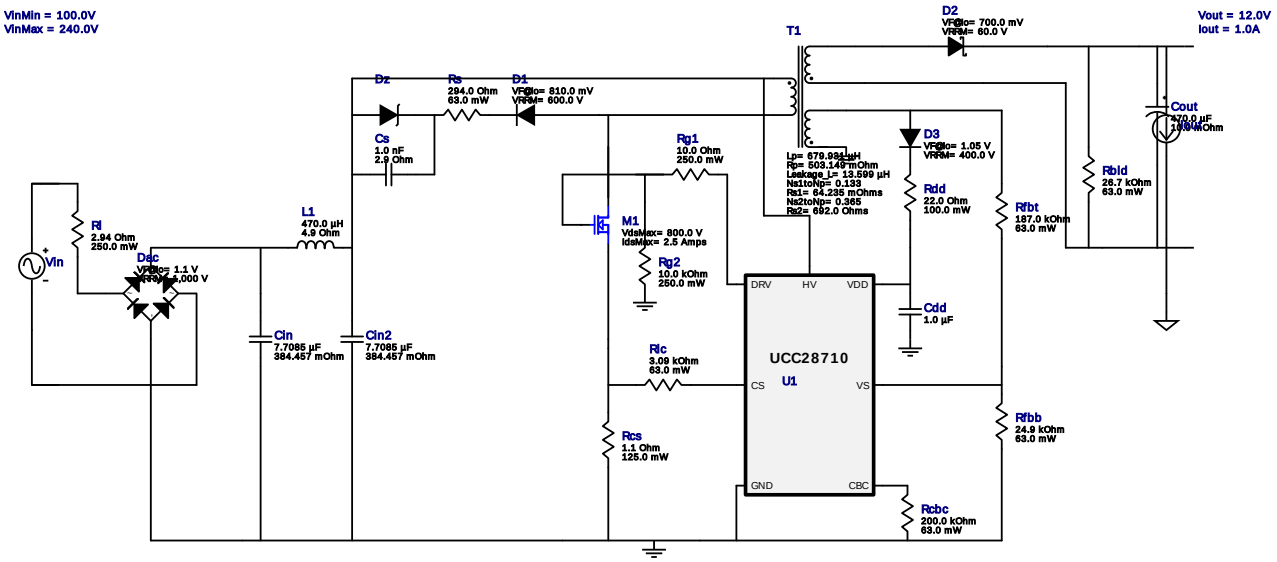
WEBENCH® Design Report

VinMin = 100.0V
VinMax = 240.0V
Vout = 12.0V
Iout = 1.0A

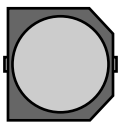
Device = UCC28710DR
Topology = Flyback
Created = 6/10/15 12:53:01 AM
BOM Cost = $0.00
Footprint = 749.0 mm^2
BOM Count = 25
Total Pd = 2.38W

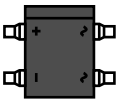
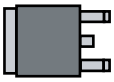
Design : 4388007/2 UCC28710DR
UCC28710DR 100.0V-240.0V to 12.67V @ 1.0A

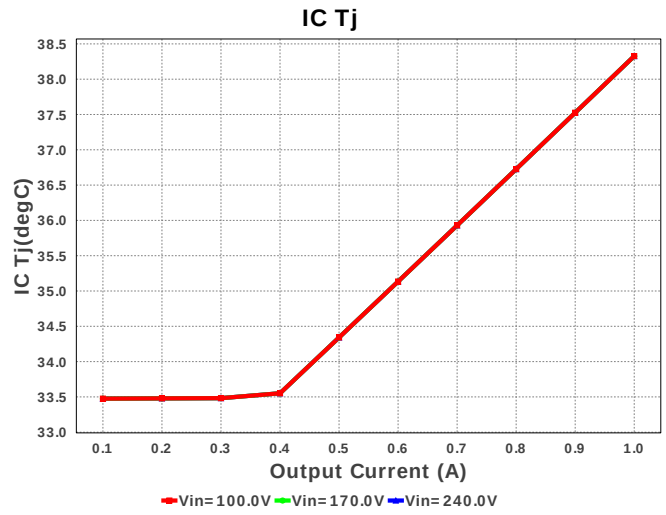


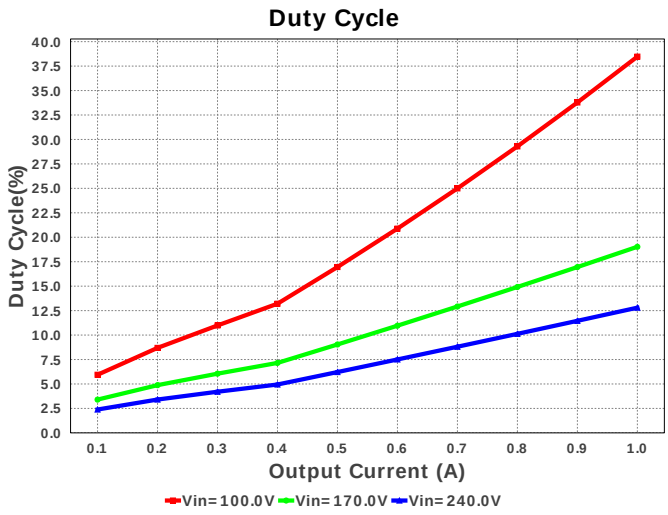
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

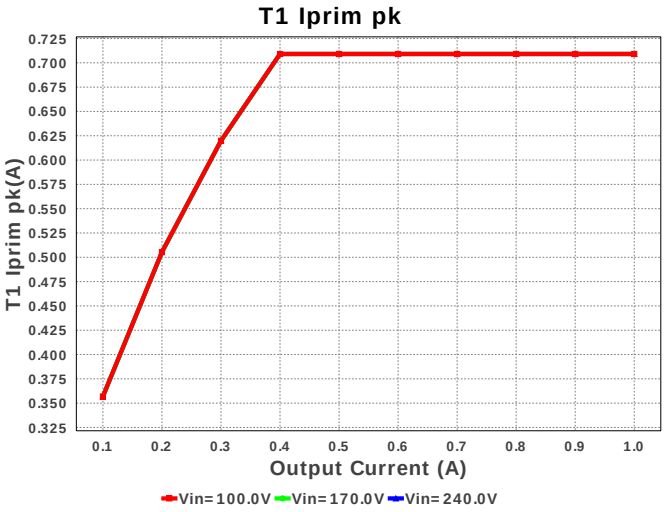
Electrical BOM

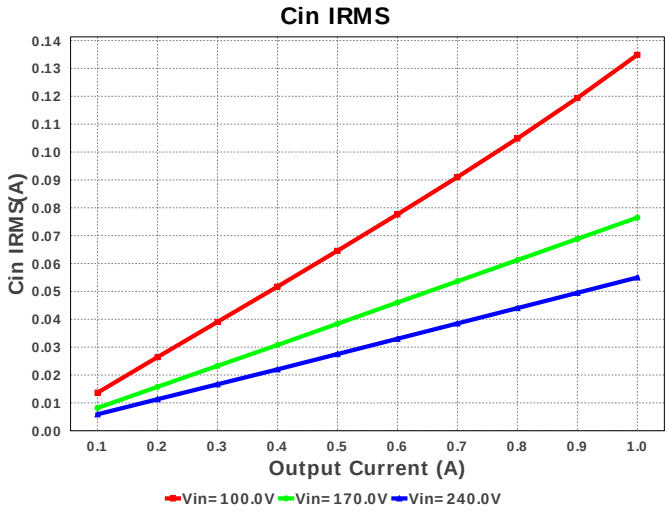
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 35.0 V IRMS= 0.0 A	1	$0.05	 0805 7 mm^2
2.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 7.7085 uF ESR= 384.457 mOhm VDC= 509.11 V IRMS= 545.17 mA	1	NA	CUSTOM 0 mm^2
3.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 7.7085 uF ESR= 384.457 mOhm VDC= 509.11 V IRMS= 545.17 mA	1	NA	CUSTOM 0 mm^2
4.	Cout	Panasonic	16SVPE470M Series= 259	Cap= 470.0 uF ESR= 10.0 mOhm VDC= 16.0 V IRMS= 6.1 A	1	$0.88	 CAPSMT_62_JC0 156 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	ON Semiconductor	MURS360T3	VF@Io= 810.0 mV VRRM= 600.0 V	1	$0.24	 SMC 83 mm^2
7.	D2	Diodes Inc.	B260A-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.11	 SMA 37 mm^2

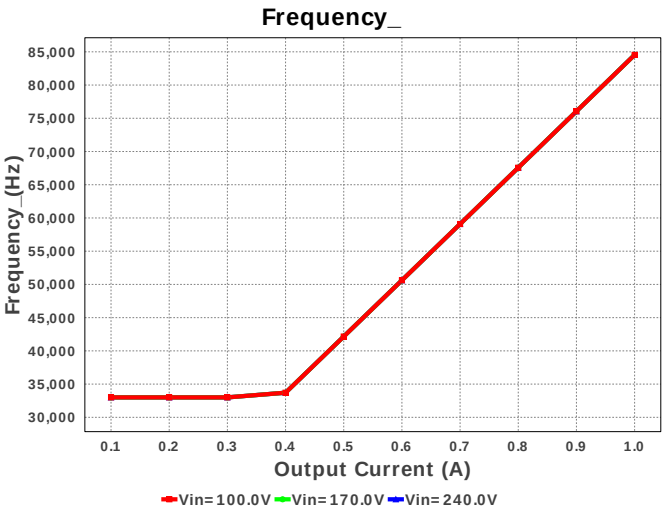
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	D3	Bourns	CD1408-FU1400	VF@Io= 1.05 V VRRM= 400.0 V	1	$0.13	 Diode_1408 13 mm^2
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	$0.24	 DF-S 99 mm^2
10.	Dz	ON Semiconductor	BZG03C150G	Zener	1	$0.12	 SMA 37 mm^2
11.	L1	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	CRCW040226K7FKED Series= CRCW..e3	Res= 26.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
14.	Rcbc	Vishay-Dale	CRCW0402200KFKED Series= CRCW..e3	Res= 200.0 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	CRCW040224K9FKED Series= CRCW..e3	Res= 24.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Rfbt	Vishay-Dale	CRCW0402187KFKED Series= CRCW..e3	Res= 187.0 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	CRCW12062R94FKEA Series= CRCW..e3	Res= 2.94 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
22.	Rlc	Vishay-Dale	CRCW04023K09FKED Series= CRCW..e3	Res= 3.09 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Rs	Vishay-Dale	CRCW0402294RFKED Series= CRCW..e3	Res= 294.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
24.	T1	CUSTOM	CUSTOM	Lp= 679.931 µH Rp= 503.149 mOhm Leakage_L= 13.599 µH Ns1toNp= 0.133 Rs1= 64.235 mOhms Ns2toNp= 0.365 Rs2= 692.0 Ohms	1	NA	CUSTOM 0 mm^2
25.	U1	Texas Instruments	UCC28710DR	Switcher	1	$0.42	 SOIC-7 0 mm^2

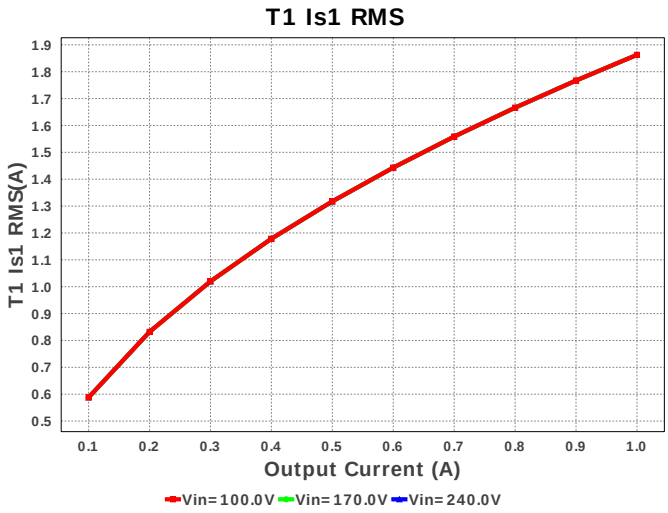


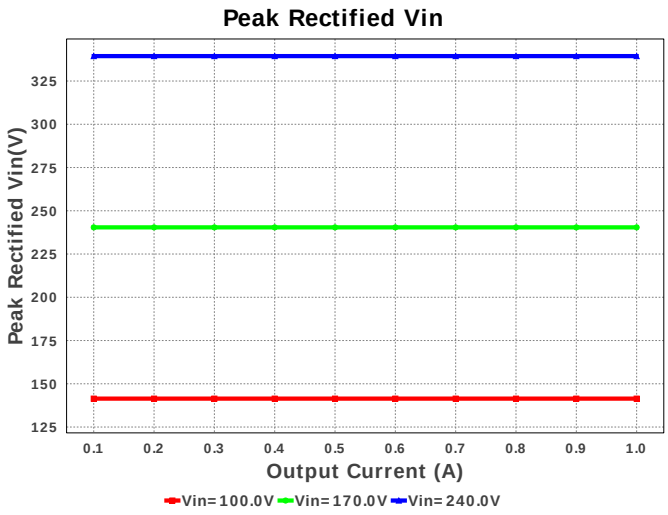


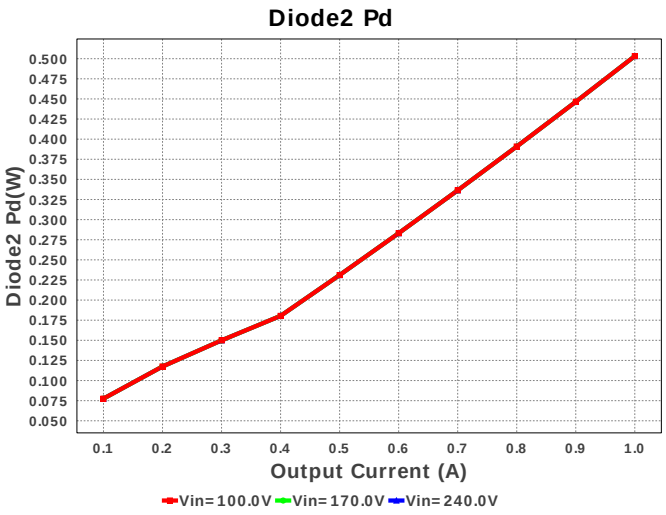


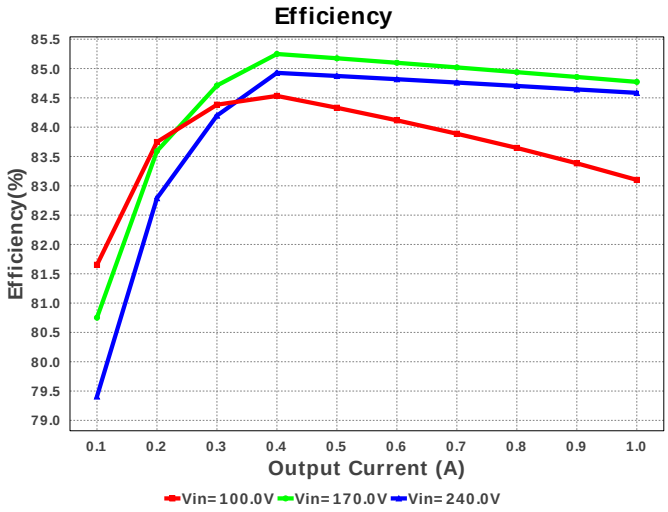


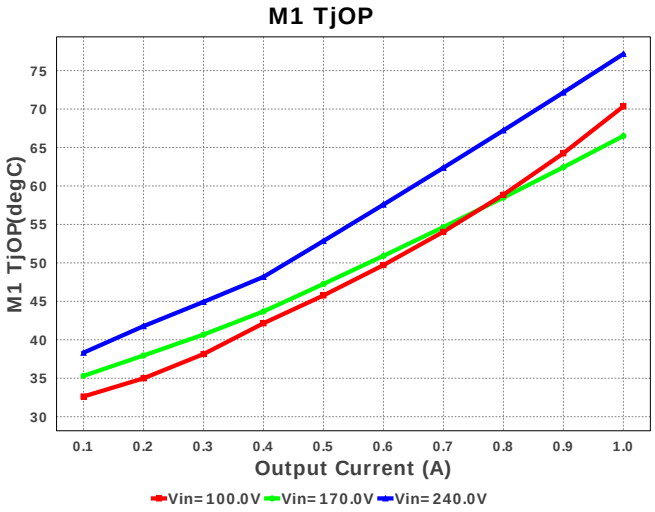


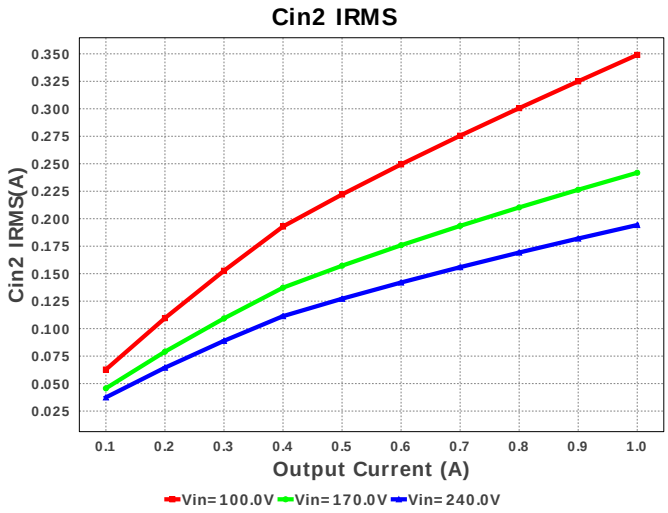


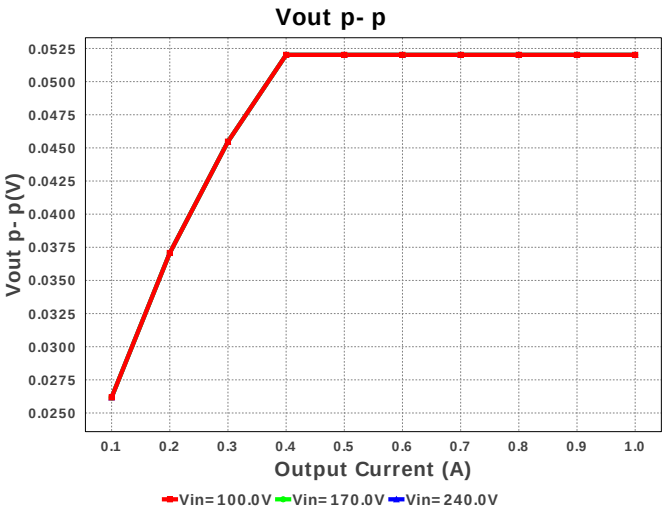


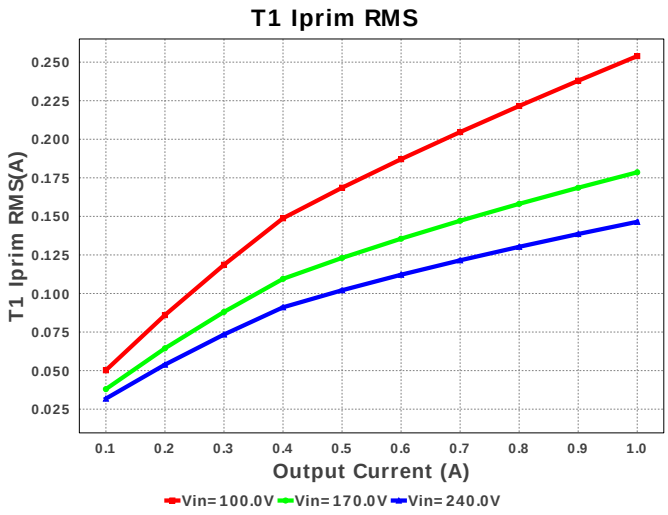


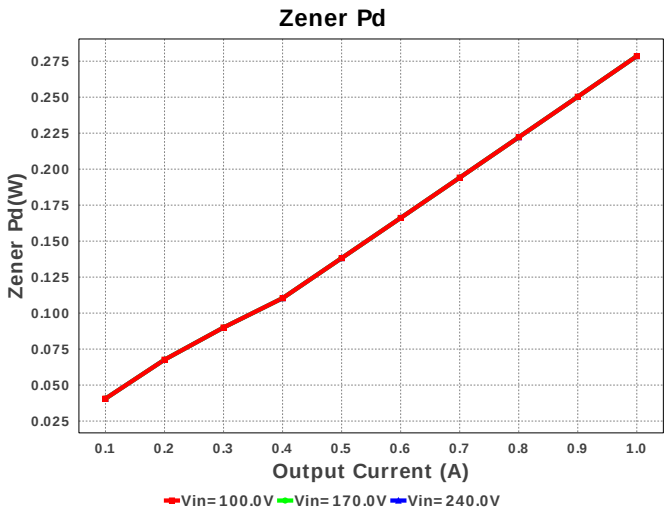


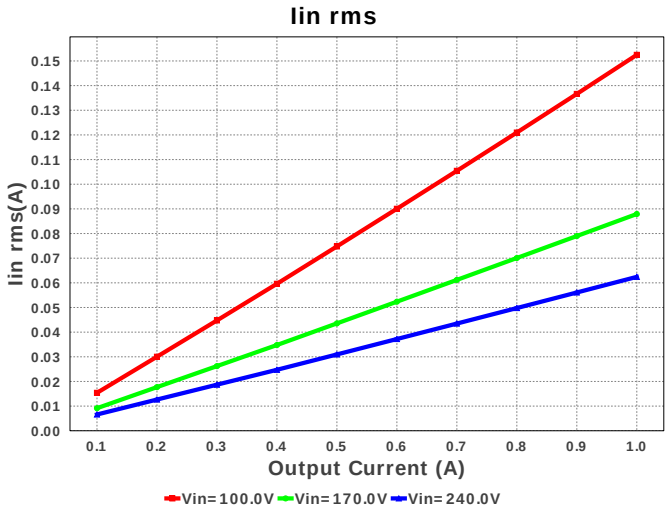


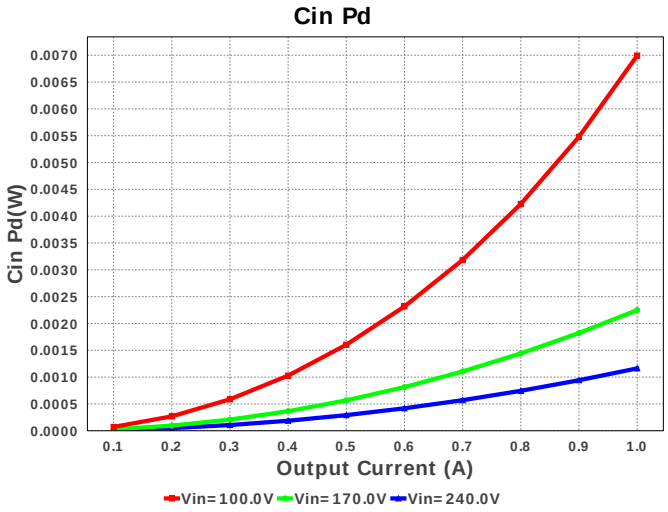


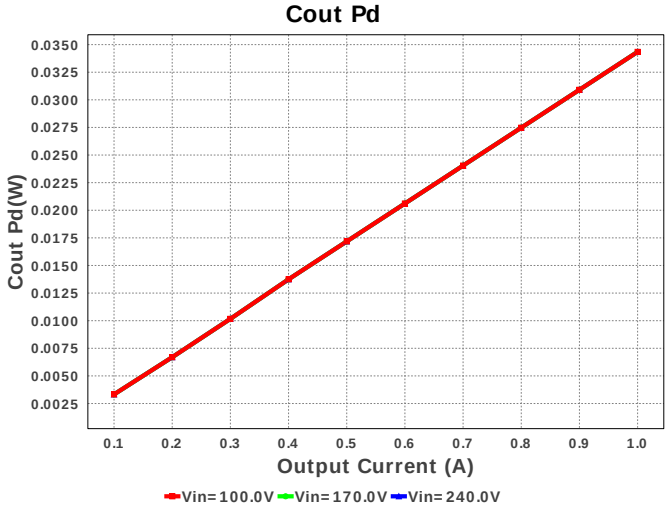


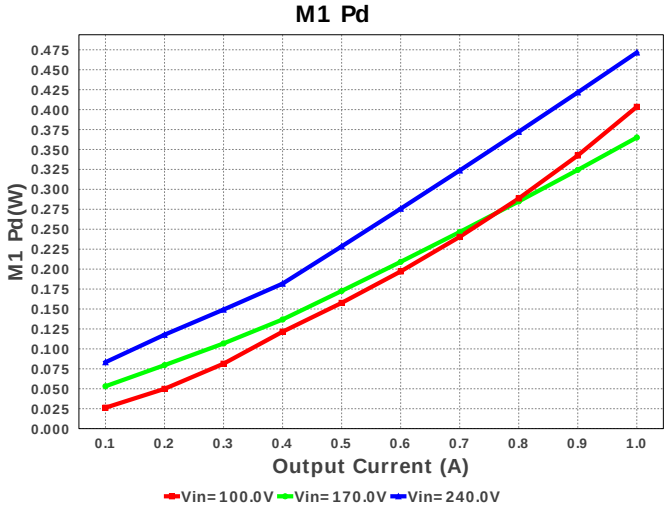


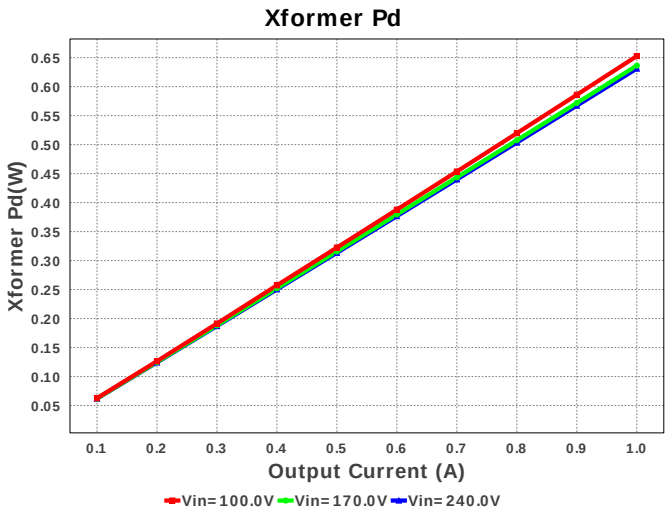


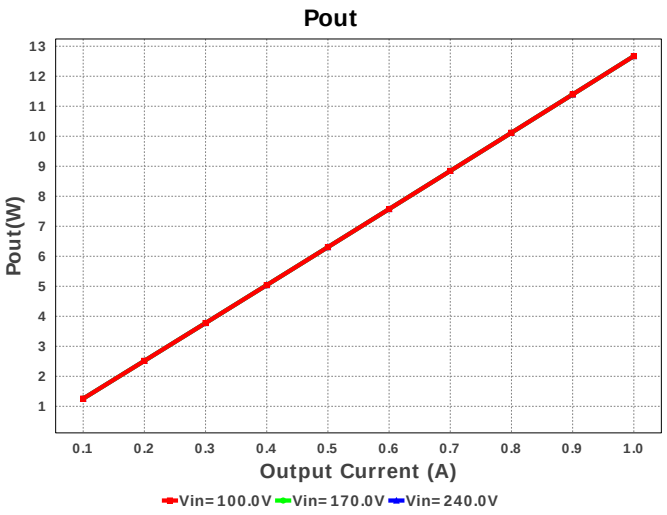


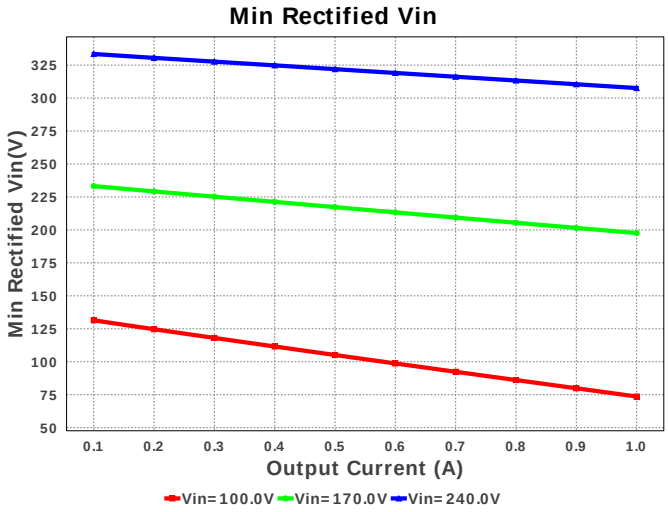


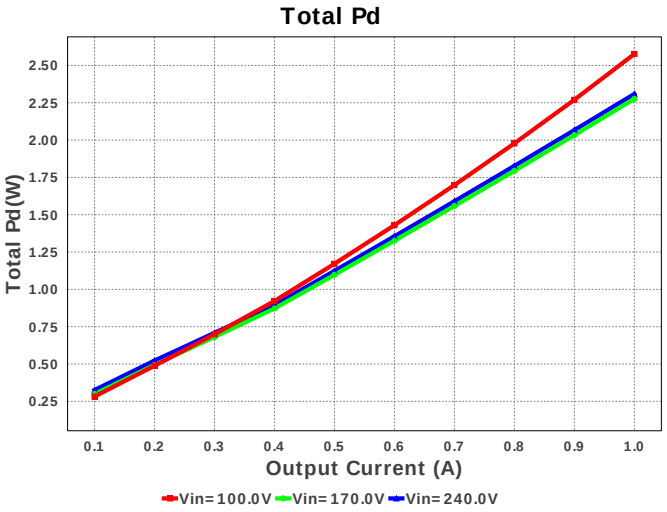


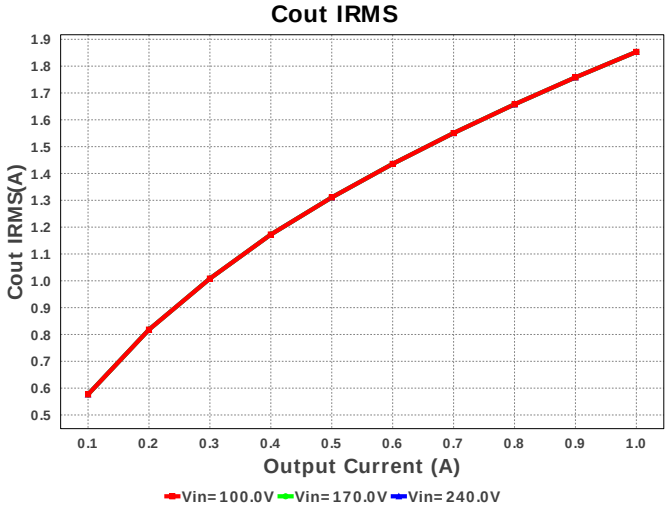


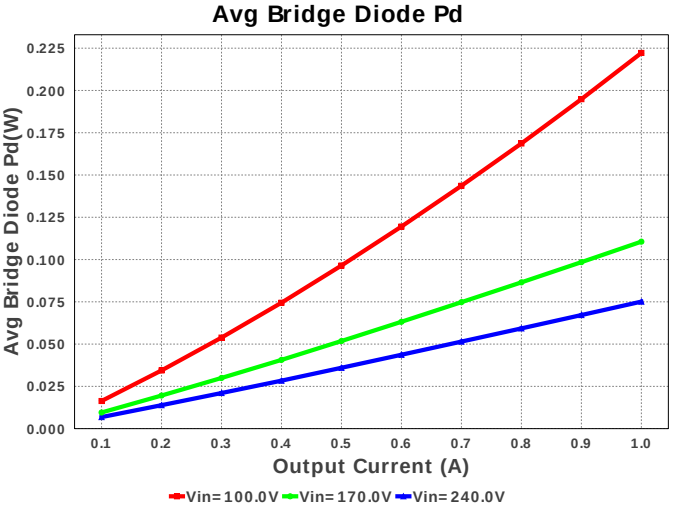


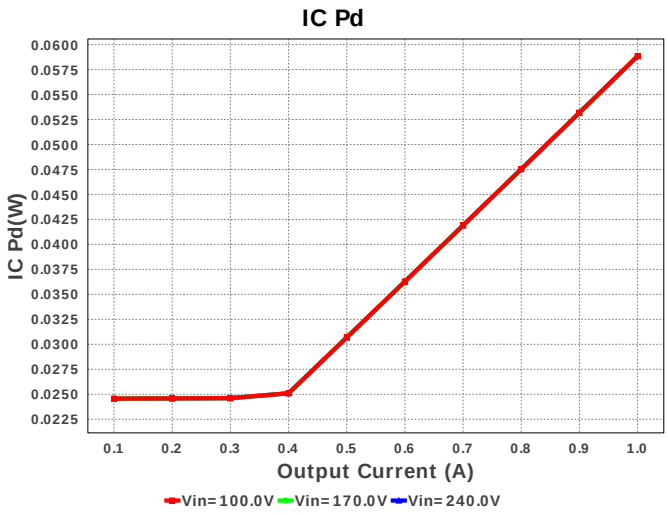


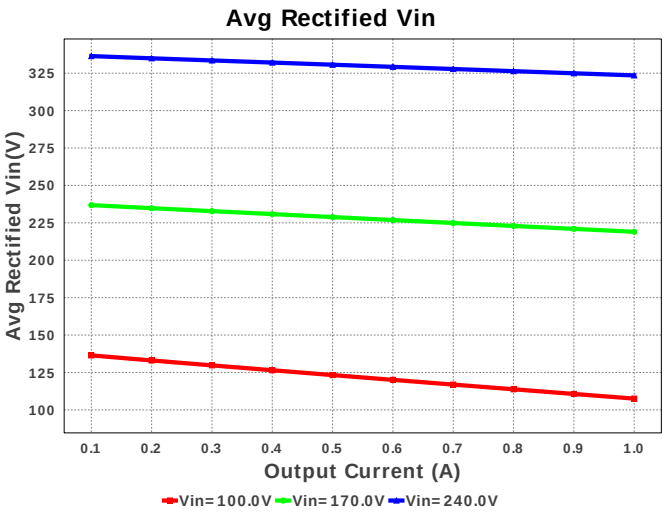


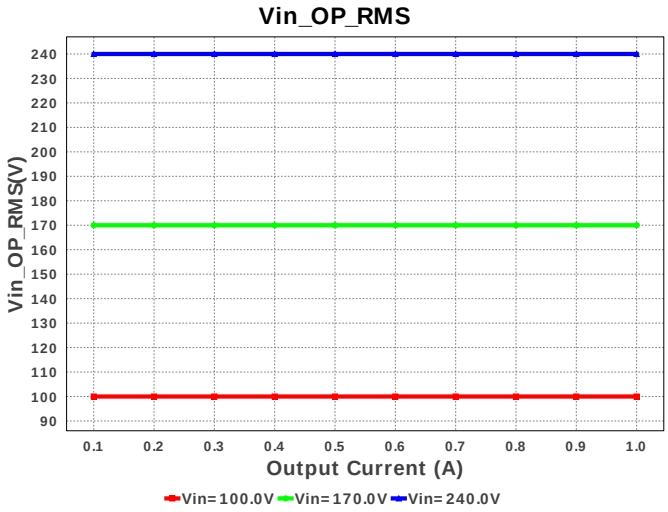


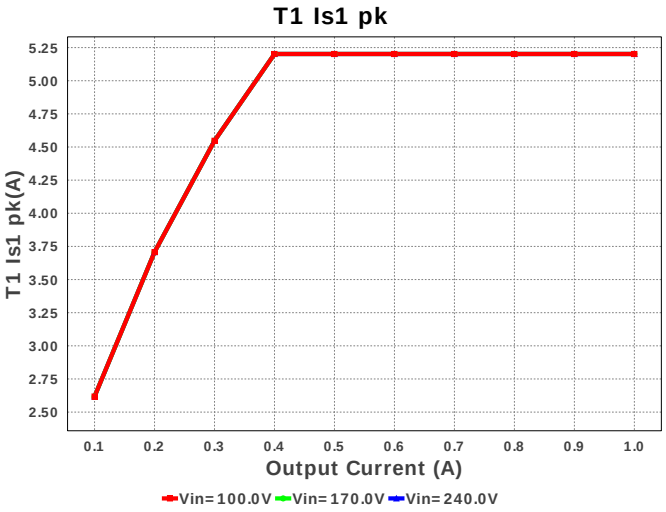


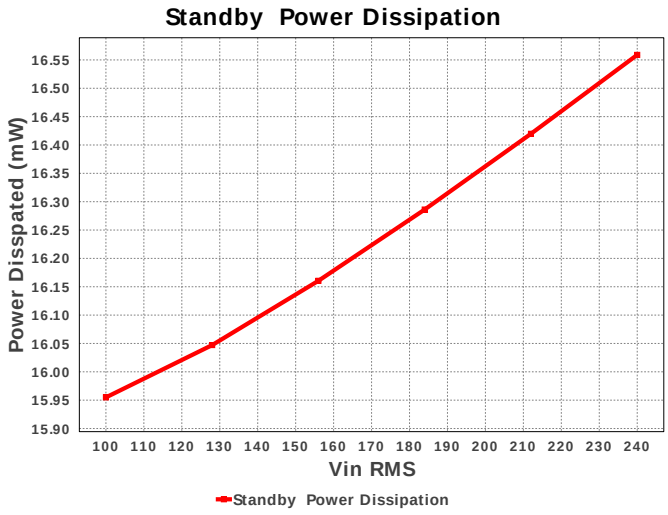


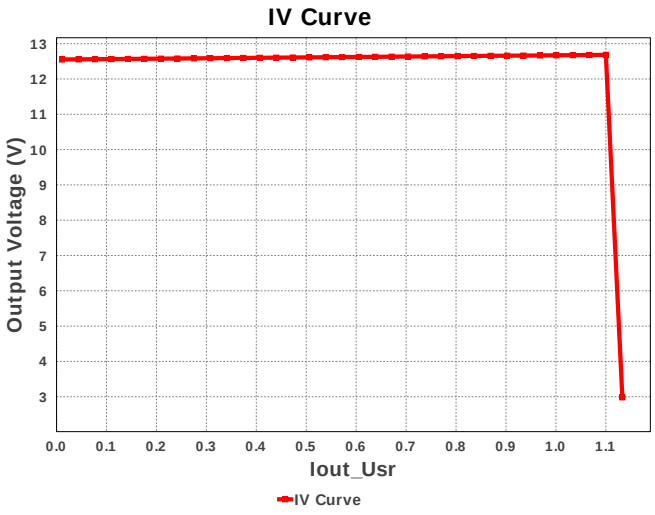












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	55.506 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	194.503 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	1.853 A	Current	Output capacitor RMS ripple current
4.	Iin rms	62.726 mA	Current	RMS Input Current
5.	T1 Iprim RMS	146.158 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	709.091 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	1.863 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	5.202 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	326.141 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	25	General	Total Design BOM count
11.	FootPrint	749.0 mm^2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Pout	12.672 W	General	Total output power
13.	Total BOM	$0.0	General	Total BOM Cost
14.	Vout OP	12.672 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	12.746 %	Op_point	Duty cycle
16.	Efficiency	84.175 %	Op_point	Steady state efficiency
17.	Frequency_	84.947 kHz	Op_point	Switching frequency
18.	IC Tj	34.138 degC	Op_point	IC junction temperature
19.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	1.0 A	Op_point	Iout operating point
21.	M1 TjOP	77.686 degC	Op_point	M1 MOSFET junction temperature
22.	Min Rectified Vin	312.873 V	Op_point	Minimum voltage seen at rectified input
23.	Peak Rectified Vin	339.408 V	Op_point	Peak voltage seen at rectified input
24.	Vin_OP_RMS	240.0 V	Op_point	AC Input RMS Voltage
25.	Vout p-p	52.018 mV	Op_point	Peak-to-peak output ripple voltage
26.	Avg Bridge Diode Pd	67.311 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
27.	Cin Pd	1.184 mW	Power	Input capacitor power dissipation
28.	Cout Pd	34.343 mW	Power	Output capacitor power dissipation
29.	Diode2 Pd	566.749 mW	Power	Diode2 power dissipation
30.	IC Pd	59.121 mW	Power	IC power dissipation
31.	M1 Pd	476.86 mW	Power	M1 MOSFET total power dissipation
32.	Total Pd	2.382 W	Power	Total Power Dissipation
33.	Xformer Pd	632.963 mW	Power	Transformer power dissipation
34.	Zener Pd	280.761 mW	Power	Zener power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	Iout1	1.0	Output Current #1
3.	VinMax	240.0	Maximum input voltage
4.	VinMin	100.0	Minimum input voltage
5.	Vout	12.0	Output Voltage
6.	Vout1	12.0	Output Voltage #1
7.	acFrequency	60.0	Light Output in Lumen
8.	base_pn	UCC28710	Texas Instruments Base Part Number
9.	source	AC	Input Source Type
10.	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.