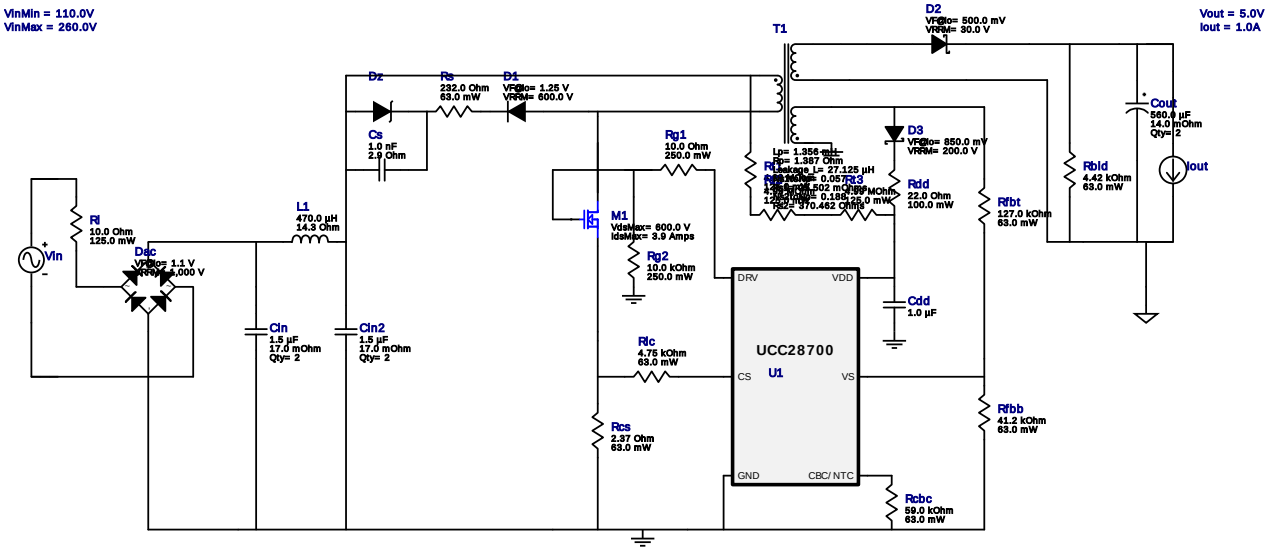
WEBENCH® Design Report

VinMin = 110.0V
VinMax = 260.0V
Vout = 5.0V
Iout = 1.0A

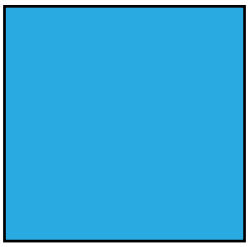
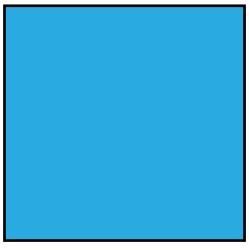
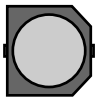
Device = UCC28700DBVR
Topology = Flyback
Created = 5/28/14 9:36:14 PM
BOM Cost = $0.00
Footprint = 2,266.0mm2
BOM Count = 31
Total Pd = 1.69W

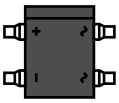
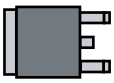
Design : 3980125/2 UCC28700DBVR
UCC28700DBVR 110.0V-260.0V to 5.108V @ 1.0A



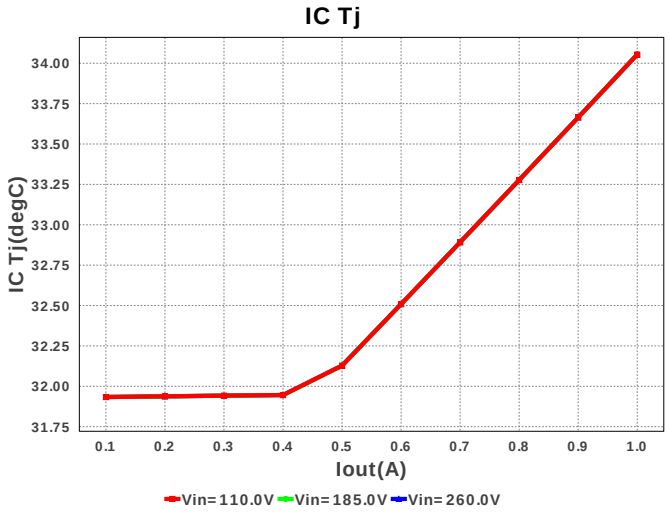
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

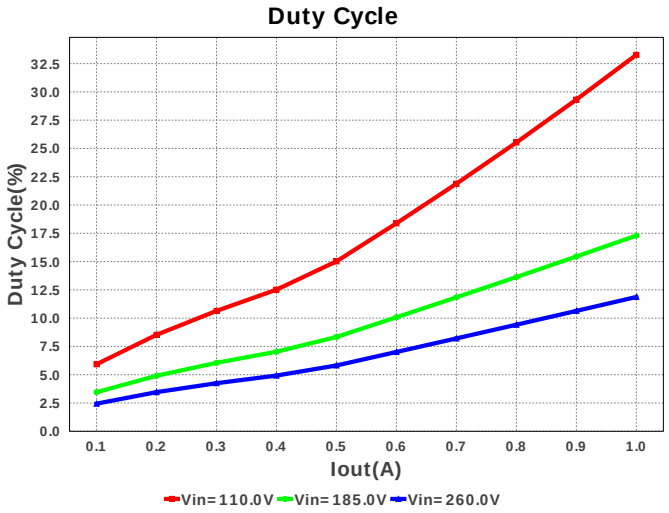
Electrical BOM

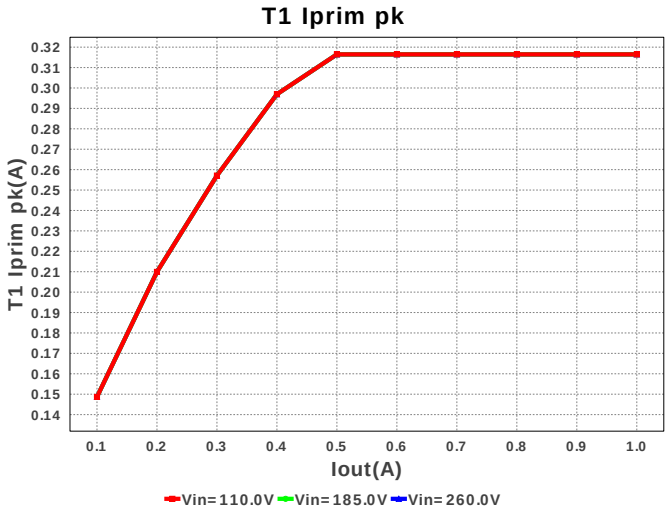
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 µF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	 0603 5mm2
2.	Cin	EPCOS Inc	B32923C3155M Series= 302	Cap= 1.5 µF ESR= 17.0 mOhm VDC= 630.0 V IRMS= 146.0 mA	2	$0.71	 B32923_22mm 399mm2
3.	Cin2	EPCOS Inc	B32923C3155M Series= 302	Cap= 1.5 µF ESR= 17.0 mOhm VDC= 630.0 V IRMS= 146.0 mA	2	$0.71	 B32923_22mm 399mm2
4.	Cout	Panasonic	16SVPF560M Series= 1273	Cap= 560.0 µF ESR= 14.0 mOhm VDC= 16.0 V IRMS= 4.95 A	2	$0.61	 CAPSMT_62_E12 106mm2
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 5mm2

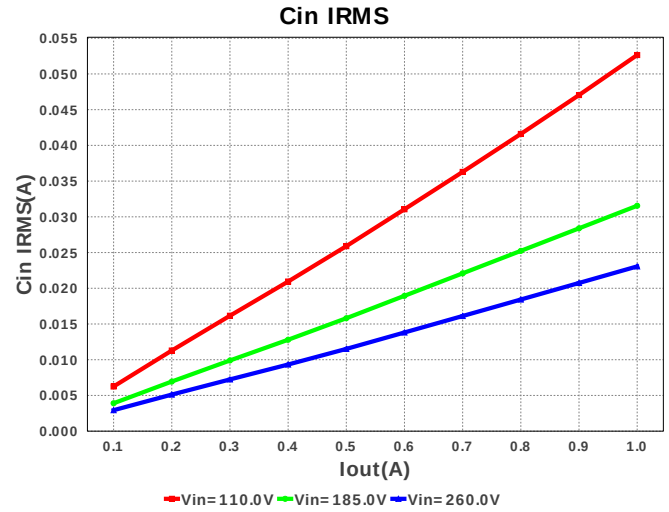
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	D1	Diodes Inc.	MURS160-13-F	VF@Io= 1.25 V VRRM= 600.0 V	1	$0.11	 SMB 44mm2
7.	D2	Diodes Inc.	B230A-13-F	VF@Io= 500.0 mV VRRM= 30.0 V	1	$0.09	 SMA 37mm2
8.	D3	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	$0.21	 PowerDI123 13mm2
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000 V	1	$0.24	 DF-S 99mm2
10.	Dz	ON Semiconductor	1SMB5949BT3G	Zener	1	$0.09	 SMB 44mm2
11.	L1	Bourns	SDR0302-471KL	L= 470.0 µH DCR= 14.3 Ohm	1	$0.17	 SDR0302 15mm2
12.	M1	Fairchild Semiconductor	FCD4N60TM	VdsMax= 600.0 V IdsMax= 3.9 Amps	1	$0.49	 DPAK 102mm2
13.	Rbld	Vishay-Dale	CRCW04024K42FKED Series= CRCW..e3	Res= 4.42 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
14.	Rcbc	Vishay-Dale	CRCW040259K0FKED Series= CRCW..e3	Res= 59.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
15.	Rcs	Vishay-Dale	CRCW04022R37FKED Series= CRCW..e3	Res= 2.37 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
16.	Rdd	Yageo America	RC0603FR-0722RL Series= 233	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5mm2
17.	Rfbb	Vishay-Dale	CRCW040241K2FKED Series= CRCW..e3	Res= 41.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
18.	Rfbt	Vishay-Dale	CRCW0402127KFKED Series= CRCW..e3	Res= 127.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
19.	Rg1	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11mm2
20.	Rg2	Panasonic	ERJ-8ENF1002V Series= ERJ-8E	Res= 10.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11mm2
21.	Rl	Vishay-Dale	CRCW080510R0FKEA Series= CRCW..e3	Res= 10.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7mm2
22.	Rlc	Vishay-Dale	CRCW04024K75FKED Series= CRCW..e3	Res= 4.75 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
23.	Rs	Vishay-Dale	CRCW0402232RFKED Series= CRCW..e3	Res= 232.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
24.	Rt1	Vishay-Dale	CRCW08054M99FKEA Series= CRCW..e3	Res= 4.99 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7mm2
25.	Rt2	Vishay-Dale	CRCW08054M99FKEA Series= CRCW..e3	Res= 4.99 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7mm2

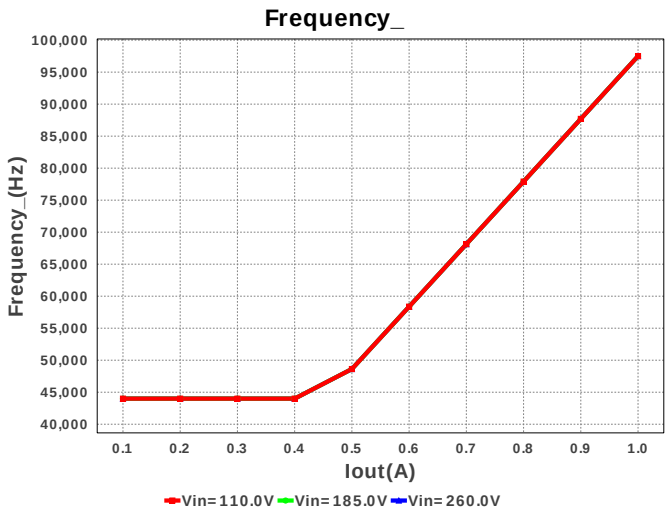
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	Rt3	Vishay-Dale	CRCW08054M99FKEA Series= CRCW..e3	Res= 4.99 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7mm2
27.	T1	CUSTOM	CUSTOM	Lp= 1.356 mH Rp= 1.387 Ohm Leakage_L= 27.125 µH Ns1toNp= 0.057 Rs1= 25.502 mOhms Ns2toNp= 0.188 Rs2= 370.462 Ohms	1	NA	CUSTOM 0mm2
28.	U1	Texas Instruments	UCC28700DBVR	Switcher	1	$0.35	SOT-23-6 15mm2

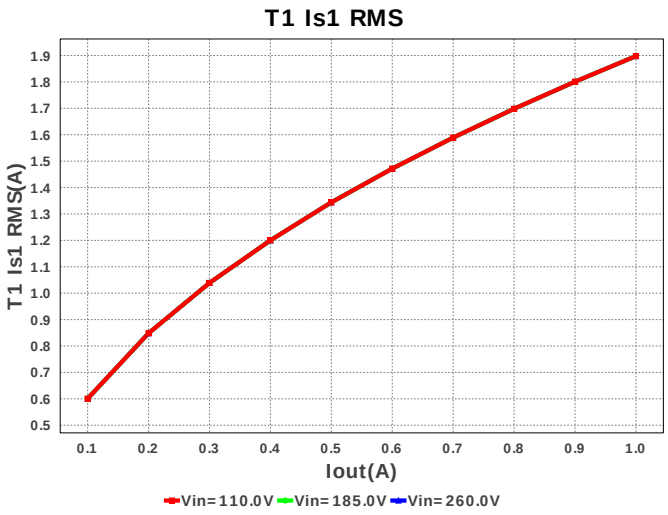


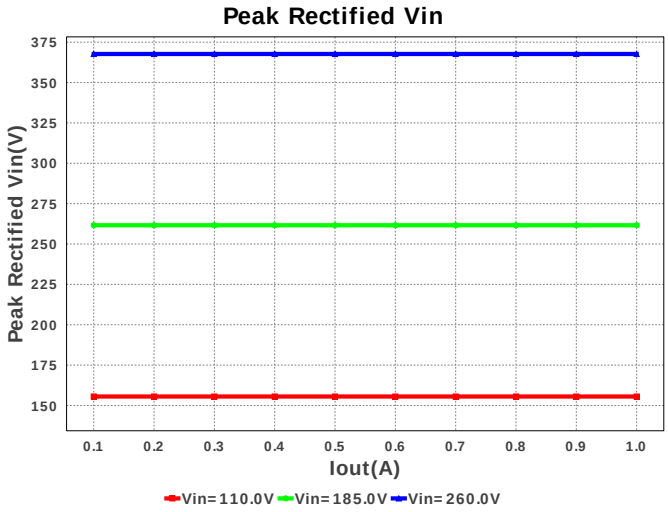


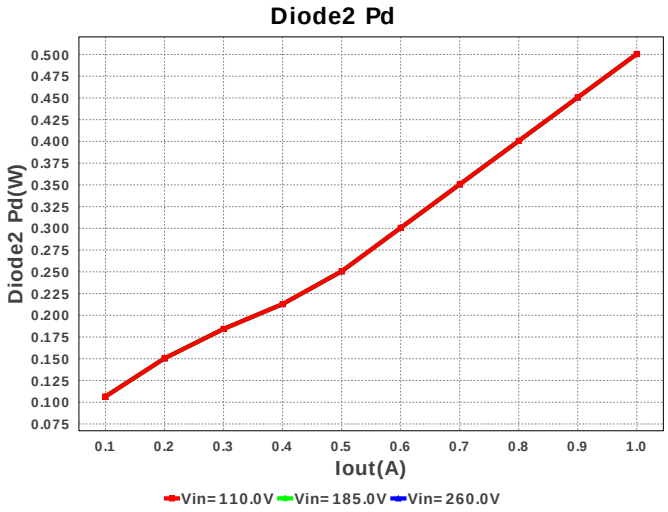


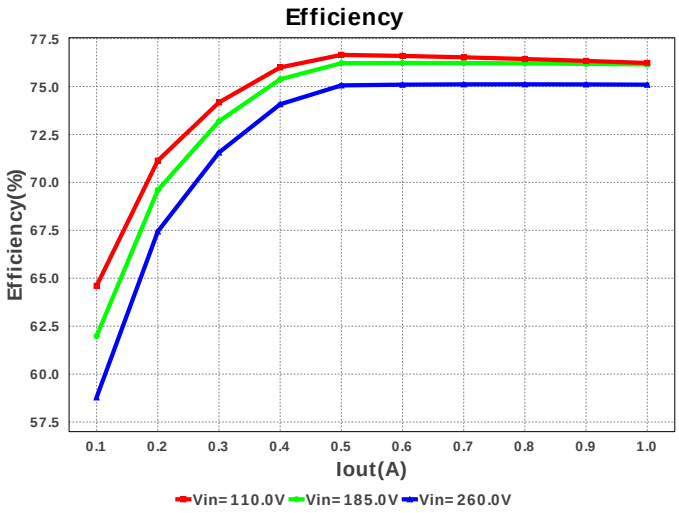


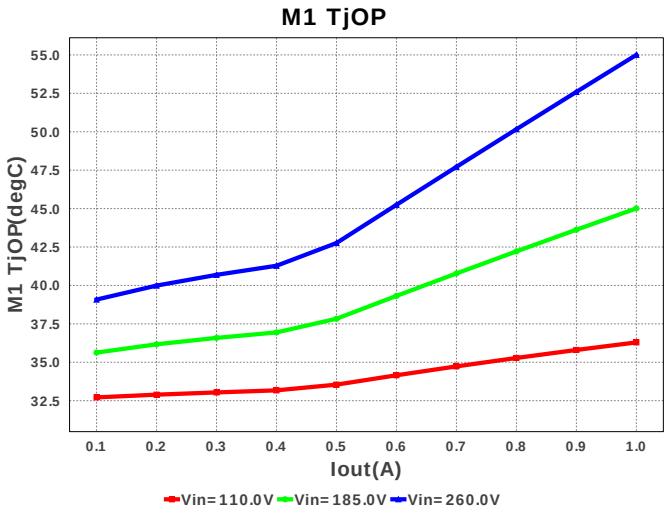


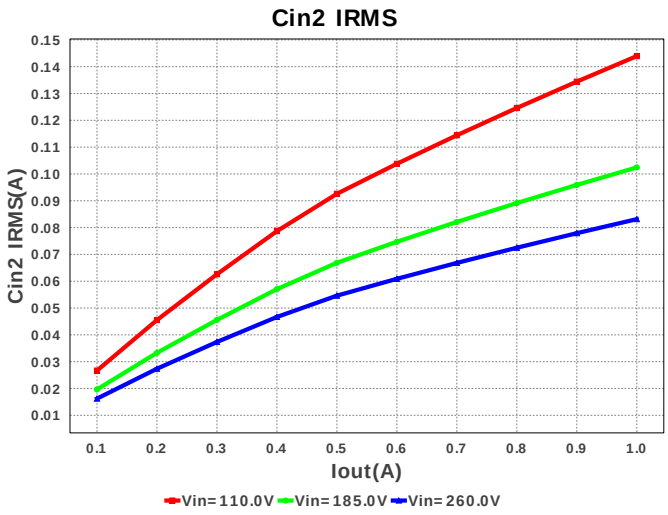


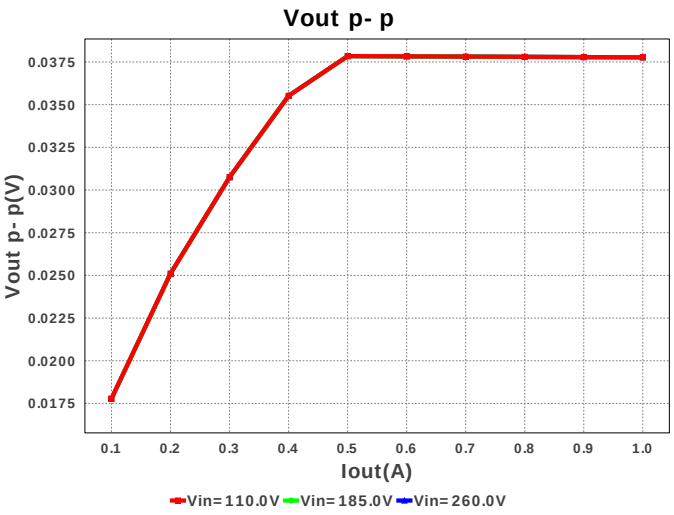


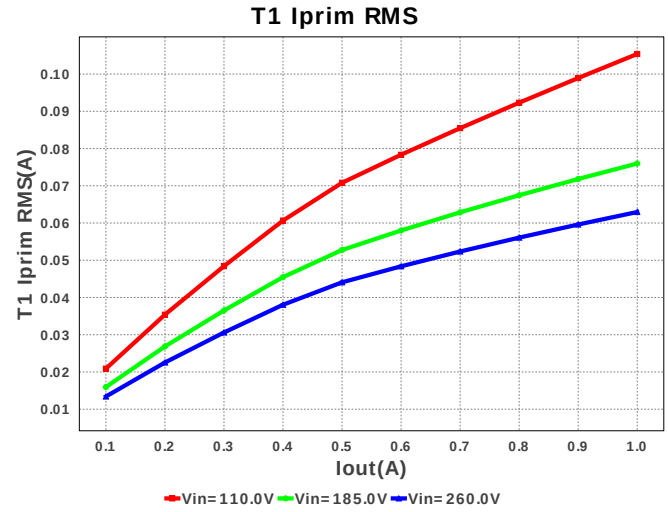


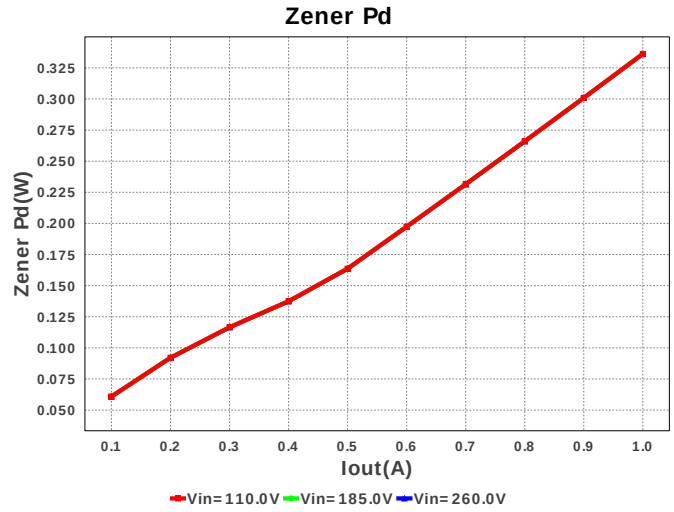


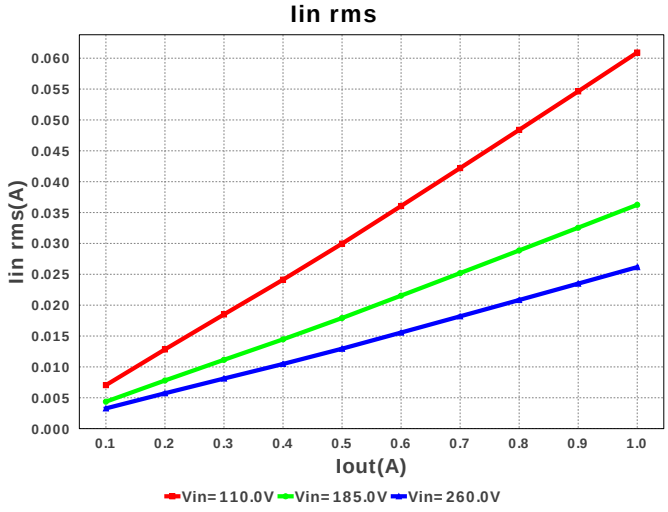


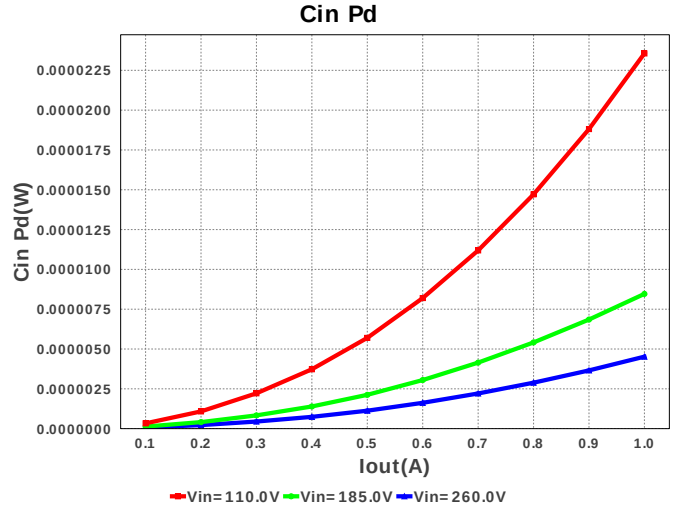


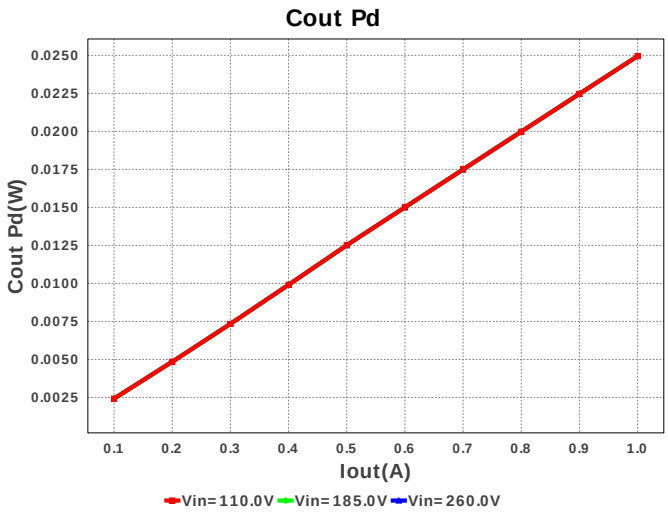


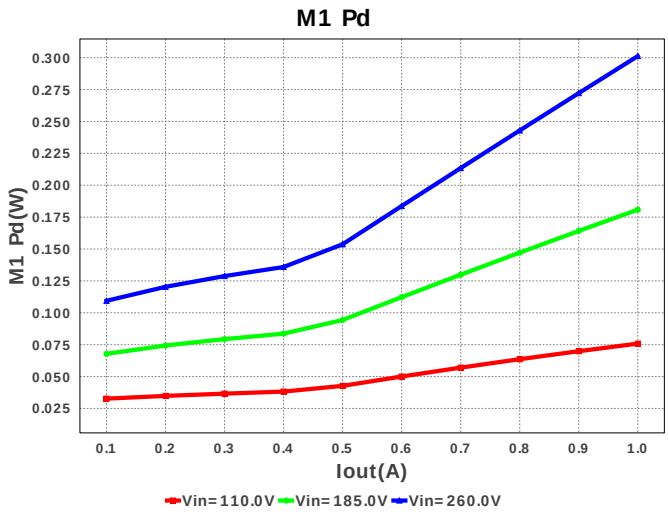


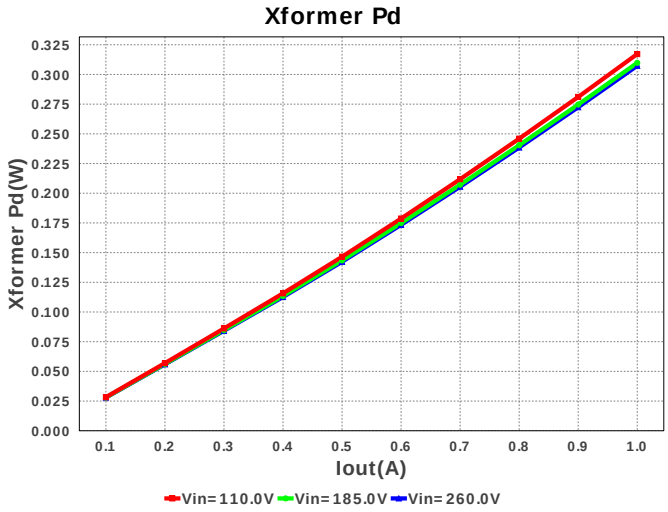


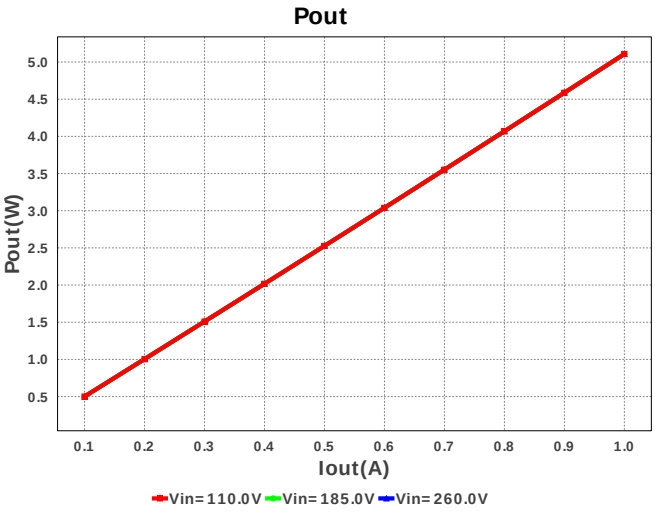


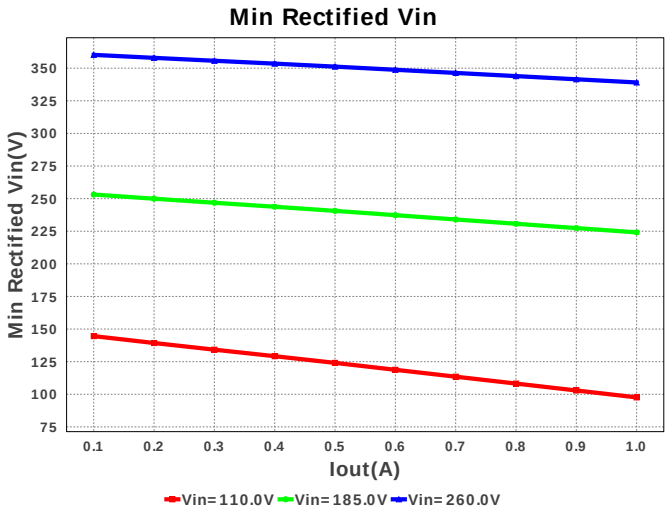


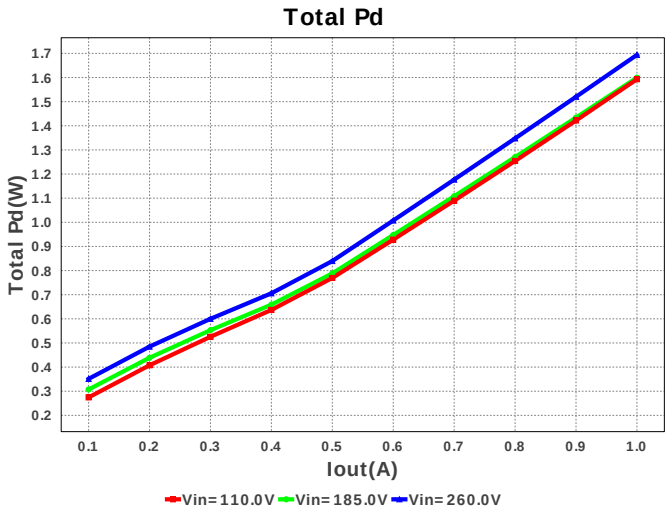


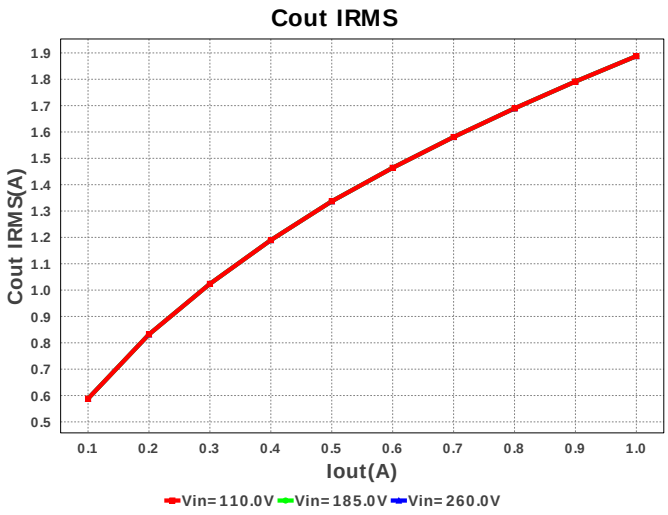


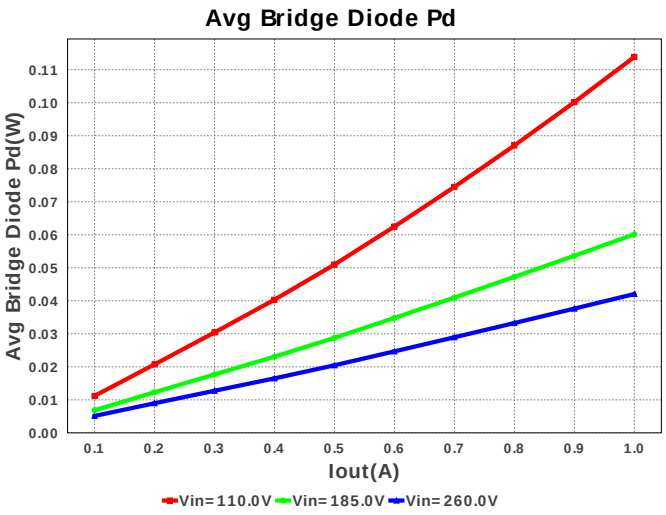


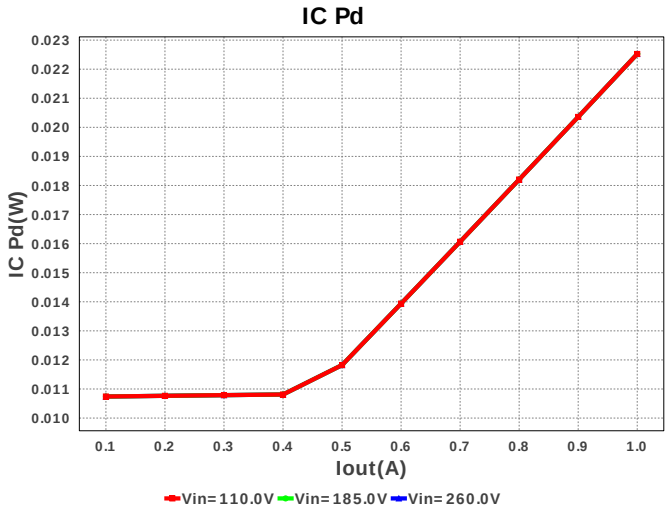


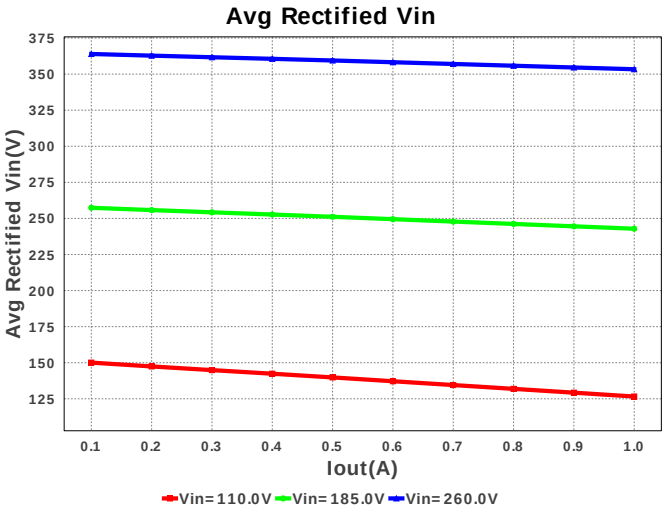


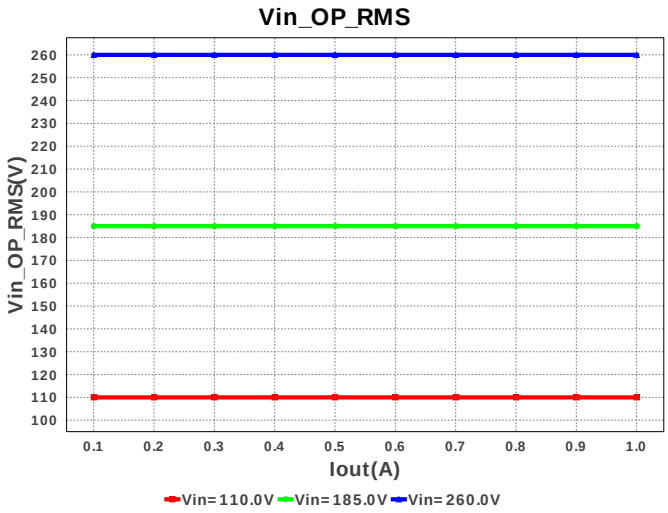


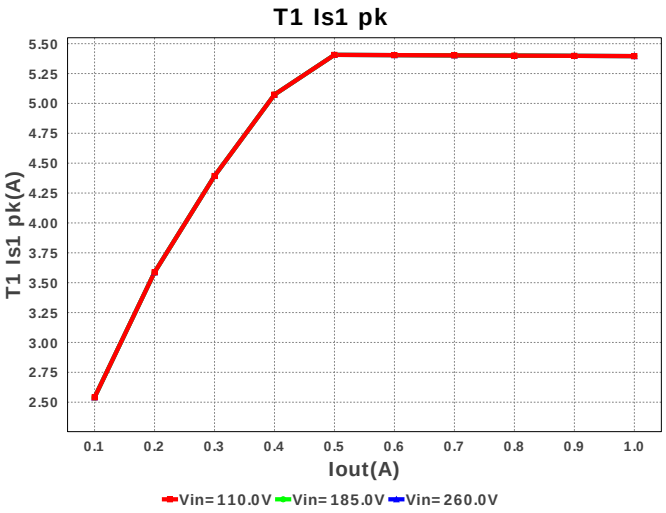


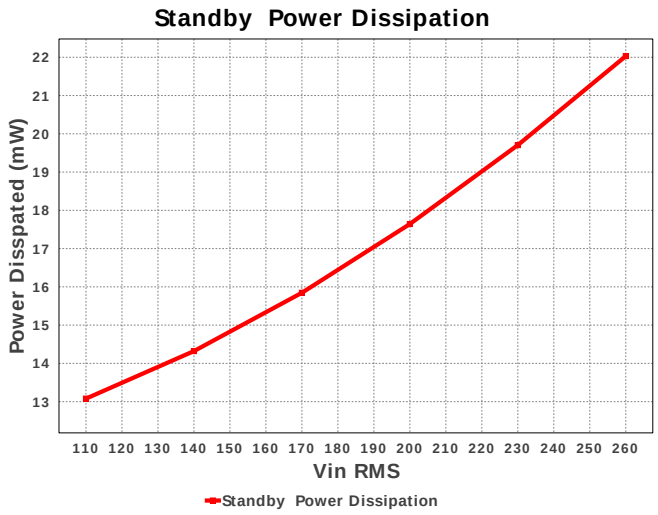


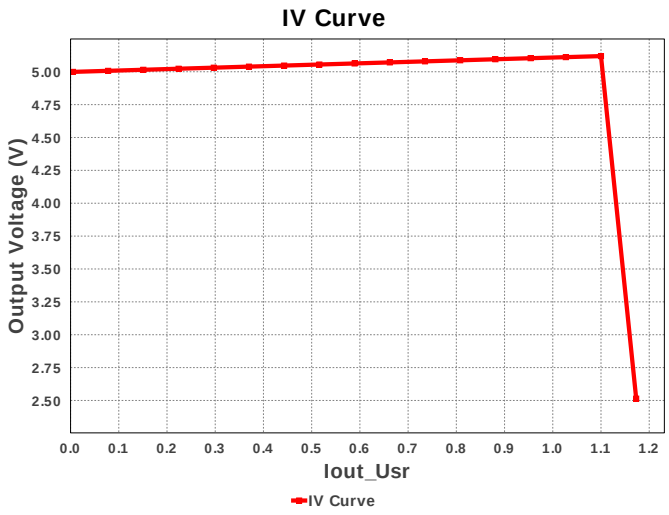












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	23.012 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	83.328 mA	Current	Input capacitor2 RMS ripple current
3.	Cout IRMS	1.888 A	Current	Output capacitor RMS ripple current
4.	Iin rms	26.164 mA	Current	RMS Input Current
5.	T1 Iprim RMS	63.222 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	316.456 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	1.898 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	5.396 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	350.382 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	31	General	Total Design BOM count
11.	FootPrint	2.266 kmm2	General	Total Foot Print Area of BOM components
12.	Pout	5.108 W	General	Total output power
13.	Total BOM	$0.0	General	Total BOM Cost
14.	Vout OP	5.108 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	11.974 %	Op_point	Duty cycle
16.	Efficiency	75.087 %	Op_point	Steady state efficiency
17.	Frequency	97.504 kHz	Op_point	Switching frequency
18.	IC Tj	31.577 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	54.717 degC	Op_point	M1 MOSFET junction temperature
22.	Min Rectified Vin	333.072 V	Op_point	Minimum voltage seen at rectified input
23.	Peak Rectified Vin	367.692 V	Op_point	Peak voltage seen at rectified input
24.	Vin_OP_RMS	260.0 V	Op_point	AC Input RMS Voltage
25.	Vout p-p	37.771 mV	Op_point	Peak-to-peak output ripple voltage
26.	Avg Bridge Diode Pd	42.403 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
27.	Cin Pd	4.501 µW	Power	Input capacitor power dissipation
28.	Cout Pd	24.949 mW	Power	Output capacitor power dissipation
29.	Diode2 Pd	500.566 mW	Power	Diode2 power dissipation
30.	IC Pd	22.523 mW	Power	IC power dissipation
31.	M1 Pd	297.799 mW	Power	M1 MOSFET total power dissipation
32.	Total Pd	1.695 W	Power	Total Power Dissipation
33.	Xformer Pd	307.333 mW	Power	Transformer power dissipation
34.	Zener Pd	336.15 mW	Power	Zener power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	1.0 A	Maximum Output Current
2.	Iout1	1.0 Amps	Output Current #1
3.	VinMax	260.0 V	Maximum input voltage
4.	VinMin	110.0 V	Minimum input voltage
5.	Vout	5.0 V	Output Voltage
6.	Vout1	5.0 Volt	Output Voltage #1
7.	base_pn	UCC28700	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0 degC	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 UCC28700 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/ucc28700.pdf

2. **UCC28700** Product Folder : http://www.ti.com/product/ucc28700 : contains the data sheet and other resources.