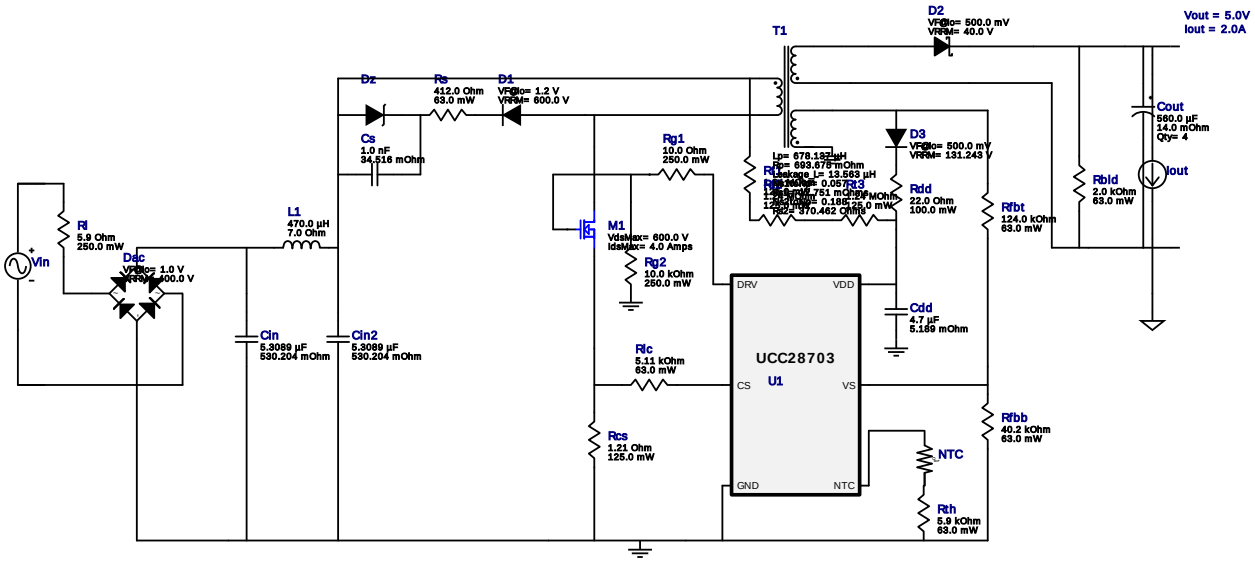
WEBENCH® Design Report

VinMin = 110.0V
VinMax = 130.0V
Vout = 5.0V
Iout = 2.0A

Device = UCC28703DBVR
Topology = Flyback
Created = 3/13/16 8:36:50 PM
BOM Cost = $0.00
BOM Count = 32
Total Pd = 2.48W

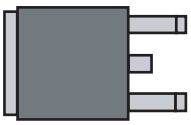
Design : 4161985/4 UCC28703DBVR
UCC28703DBVR 110.0V-130.0V to 5.26V @ 2.0A



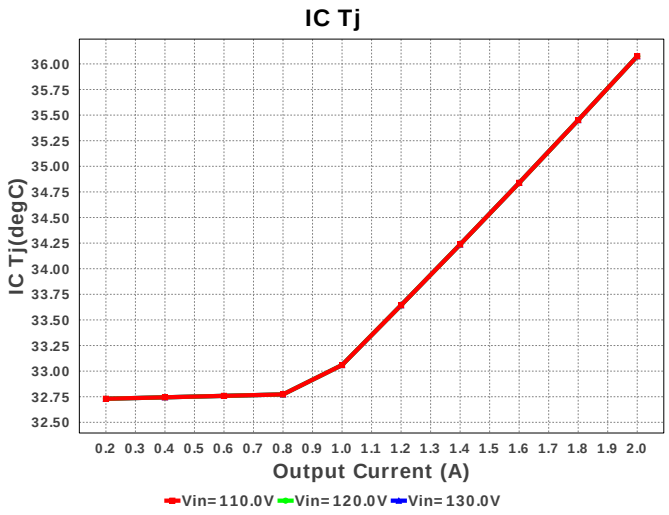
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

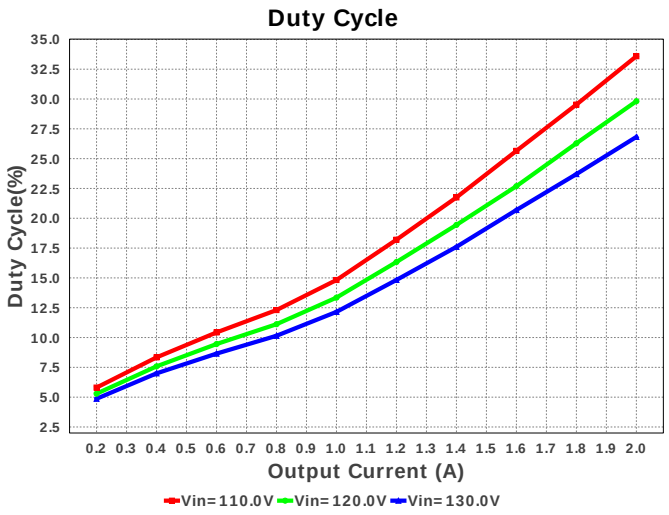
Electrical BOM

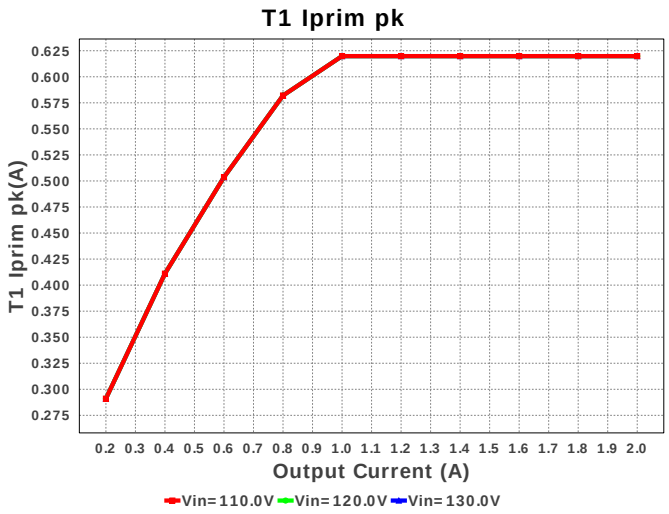
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 5.189 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	$0.03	0805 7 mm²
2.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 5.3089 uF ESR= 530.2 mOhm VDC= 275.769 V IRMS= 423.78 mA	1	NA	CUSTOM 0 mm²
3.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 5.3089 uF ESR= 530.2 mOhm VDC= 275.769 V IRMS= 423.78 mA	1	NA	CUSTOM 0 mm²
4.	Cout	Panasonic	16SVPF560M Series= SVPF	Cap= 560.0 uF ESR= 14.0 mOhm VDC= 16.0 V IRMS= 4.95 A	4	$0.61	CAPSMT_62_E12 106 mm²
5.	Cs	TDK	C2012C0G2E102J Series= C0G/NP0	Cap= 1.0 nF ESR= 34.516 mOhm VDC= 250.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
6.	D1	Bourns	CD214B-F3600	VF@Io= 1.2 V VRRM= 600.0 V	1	$0.14	SMB 44 mm²
7.	D2	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.11	SMA 37 mm²
8.	D3	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 131.243 V	1	NA	CUSTOM 0 mm²

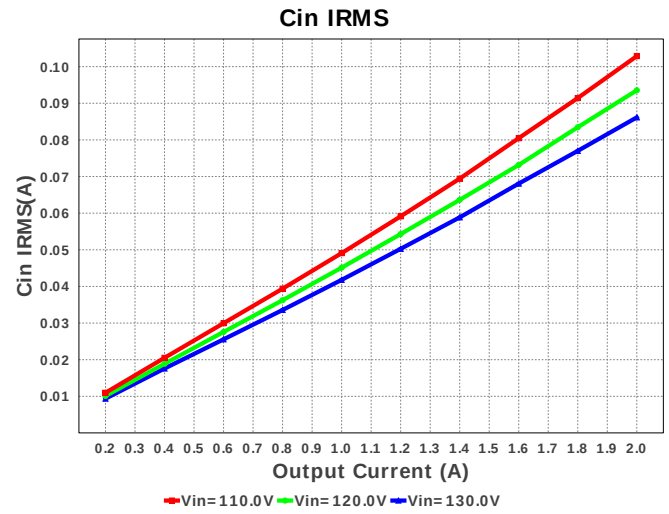
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Dac	Diodes Inc.	HD04-T	VF@Io= 1.0 V VRRM= 400.0 V	1	$0.12	 MiniDIP 62 mm^2
10.	Dz	ON Semiconductor	1SMB5949BT3G	Zener	1	$0.10	 SMB 44 mm^2
11.	L1	Bourns	SDR0403-471KL	L= 470.0 µH DCR= 7.0 Ohm	1	$0.18	 SDR0403 28 mm^2
12.	M1	STMicroelectronics	STB4NK60ZT4	VdsMax= 600.0 V IdsMax= 4.0 Amps	1	$0.53	 DDPAK 210 mm^2
13.	Rbld	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
14.	Rcs	Vishay-Dale	CRCW08051R21FKEA Series= CRCW..e3	Res= 1.21 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
15.	Rdd	Yageo America	RC0603FR-0722RL Series= ?	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
16.	Rfbb	Vishay-Dale	CRCW040240K2FKED Series= CRCW..e3	Res= 40.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
17.	Rfbt	Vishay-Dale	CRCW0402124KFKED Series= CRCW..e3	Res= 124.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	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
19.	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
20.	Rl	Vishay-Dale	CRCW12065R90FKEA Series= CRCW..e3	Res= 5.9 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
21.	Rlc	Vishay-Dale	CRCW04025K11FKED Series= CRCW..e3	Res= 5.11 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
22.	Rs	Vishay-Dale	CRCW0402412RFKED Series= CRCW..e3	Res= 412.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Rt1	Vishay-Dale	CRCW08051M24FKEA Series= CRCW..e3	Res= 1.24 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
24.	Rt2	Vishay-Dale	CRCW08051M24FKEA Series= CRCW..e3	Res= 1.24 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
25.	Rt3	Vishay-Dale	CRCW08051M24FKEA Series= CRCW..e3	Res= 1.24 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
26.	Rth	Vishay-Dale	CRCW04025K90FKED Series= CRCW..e3	Res= 5.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2

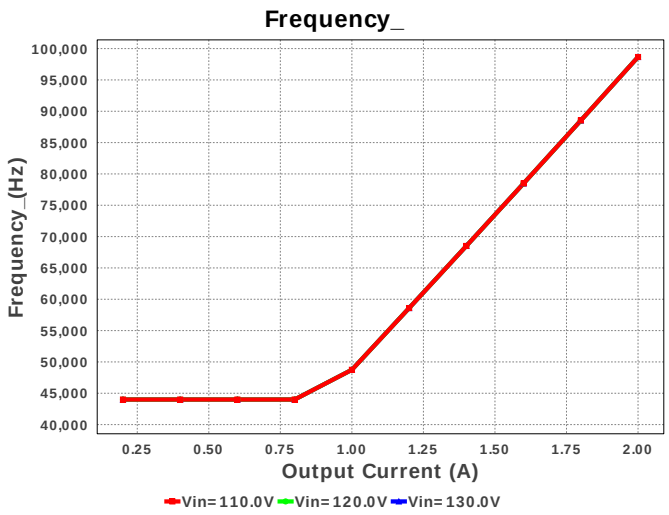
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	T1	CUSTOM	CUSTOM	Lp= 678.137 µH Rp= 693.675 mOhm Leakage_L= 13.563 µH Ns1toNp= 0.057 Rs1= 12.751 mOhms Ns2toNp= 0.188 Rs2= 370.462 Ohms	1	NA	CUSTOM 0 mm^2
28.	U1	Texas Instruments	UCC28703DBVR	Switcher	1	$0.35	SOT-23-6 15 mm^2

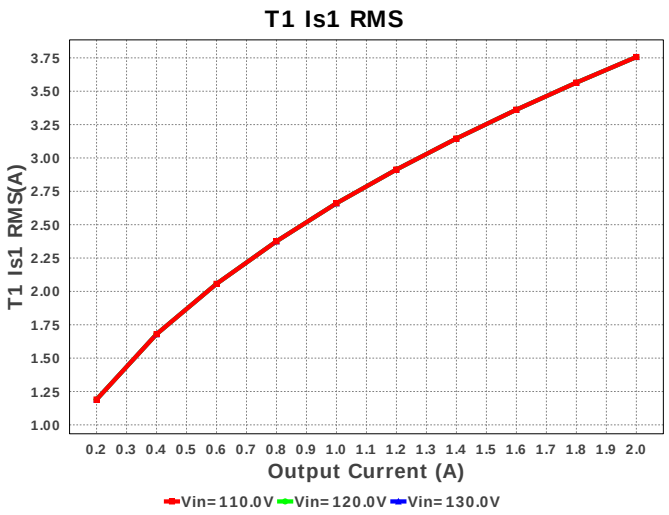


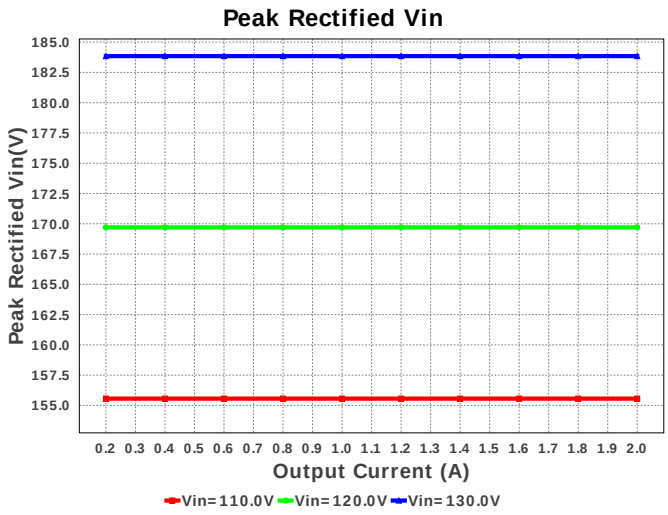


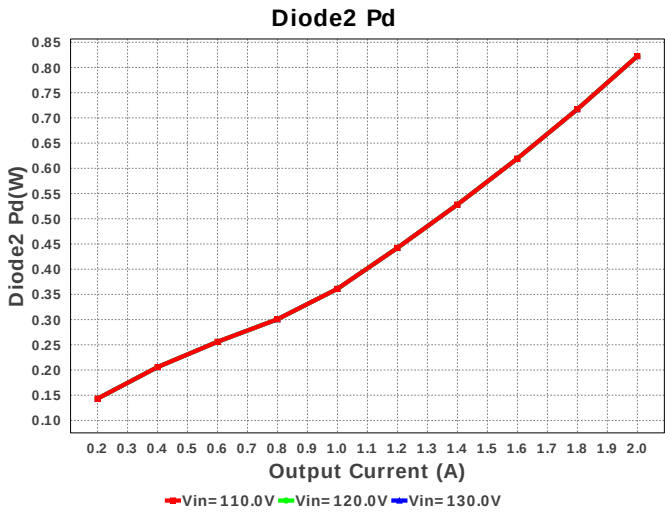


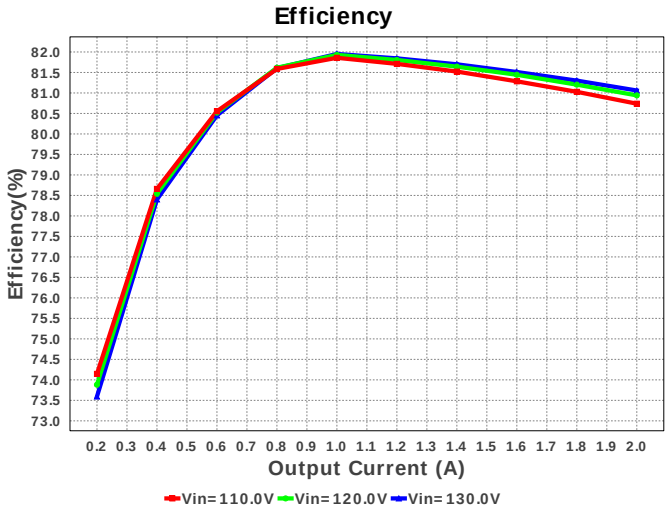


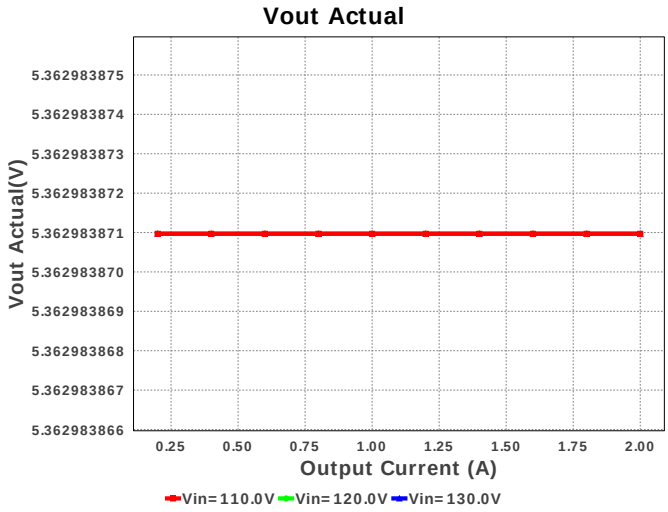


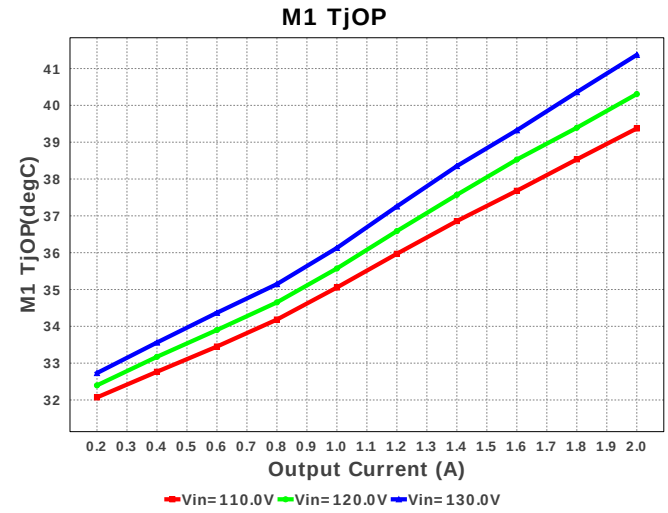


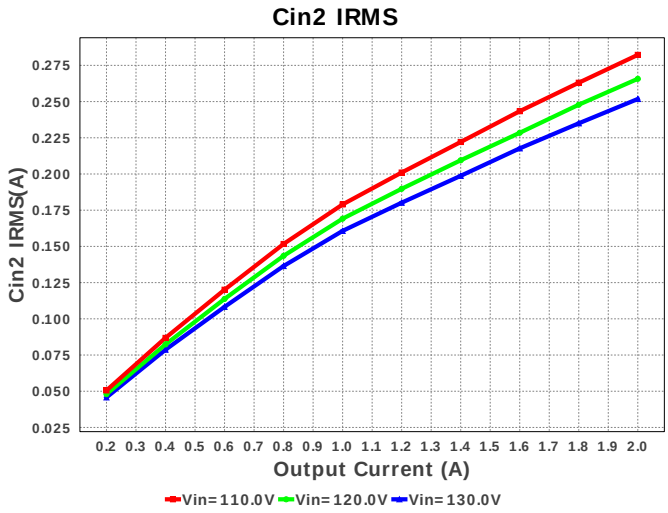


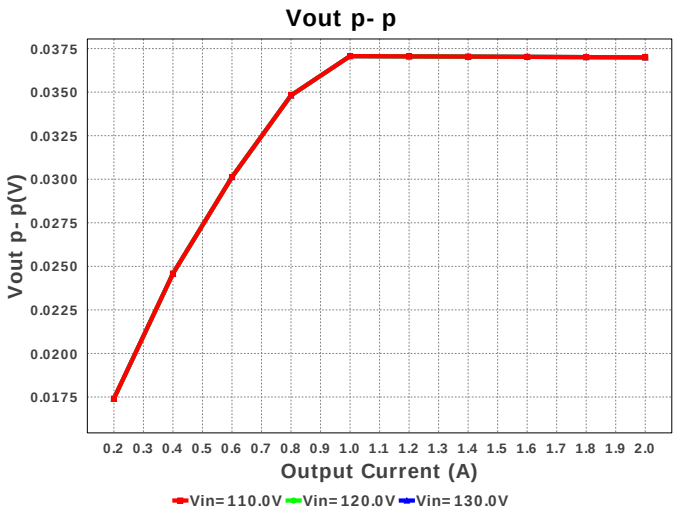


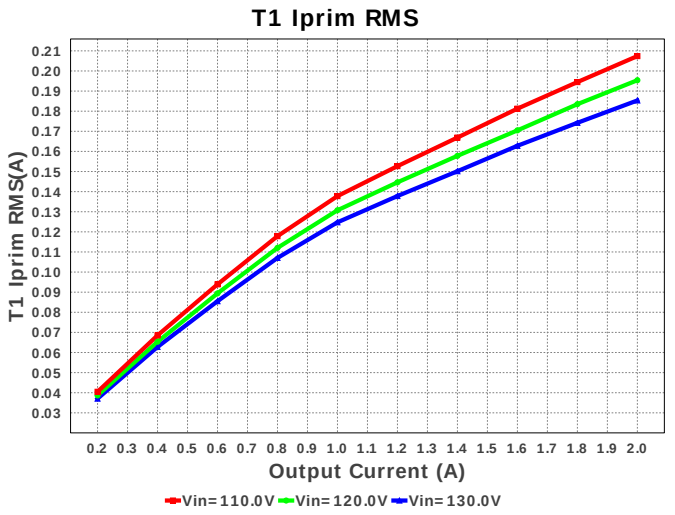


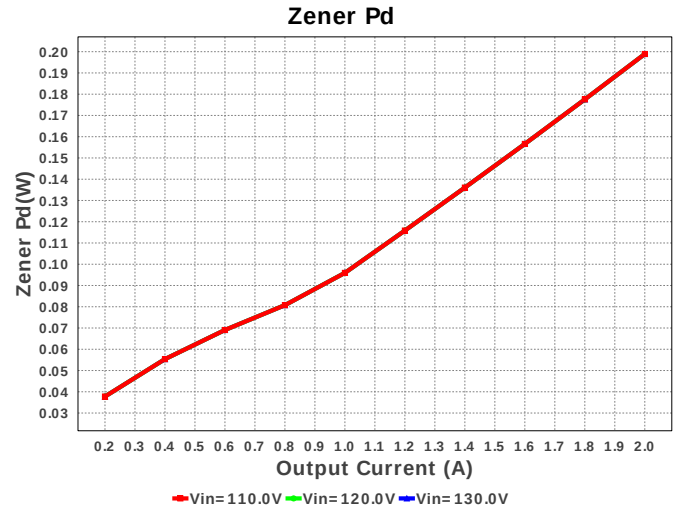


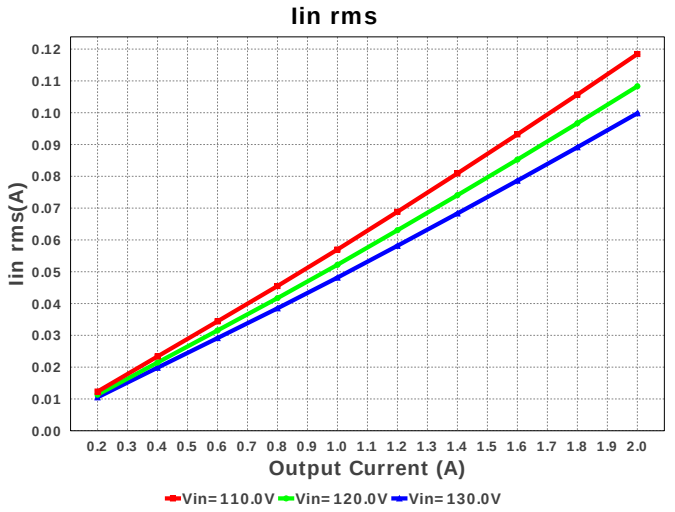


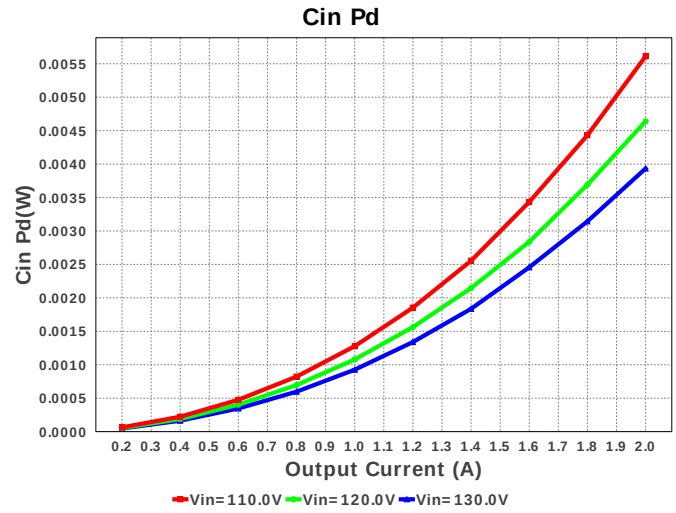


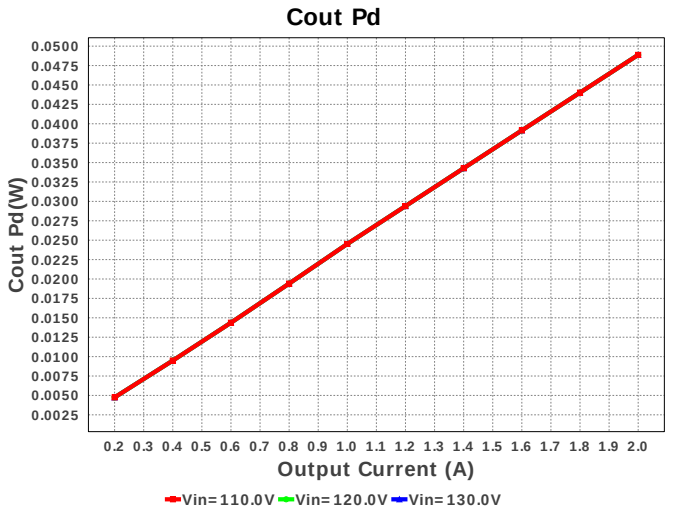


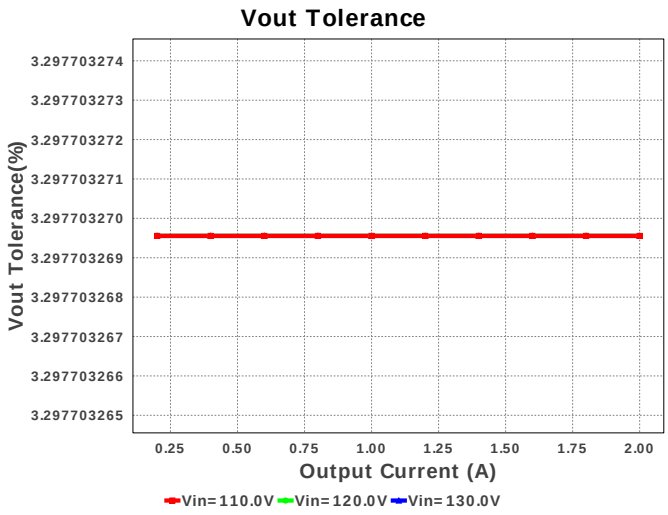


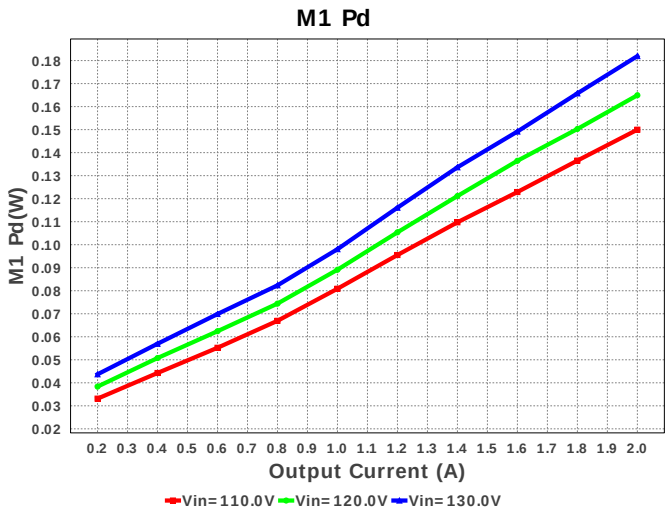


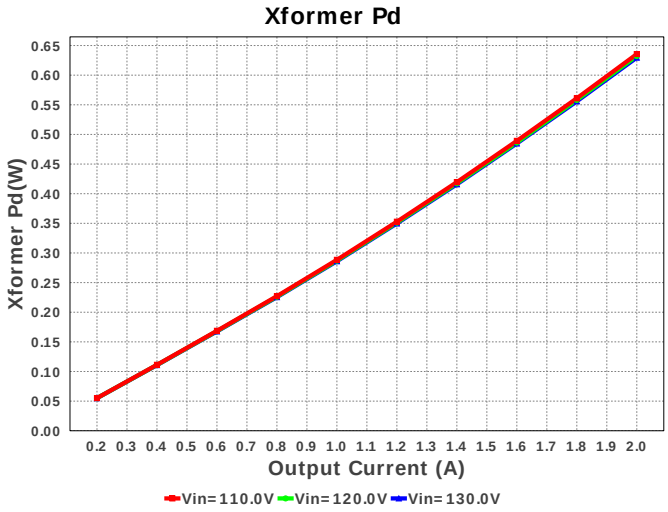


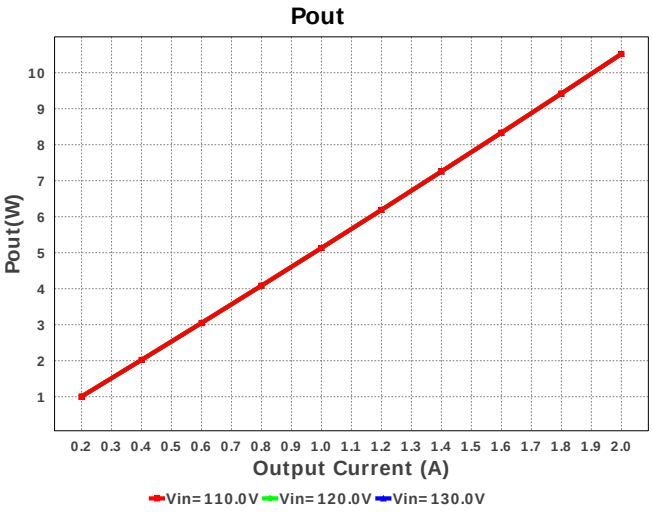


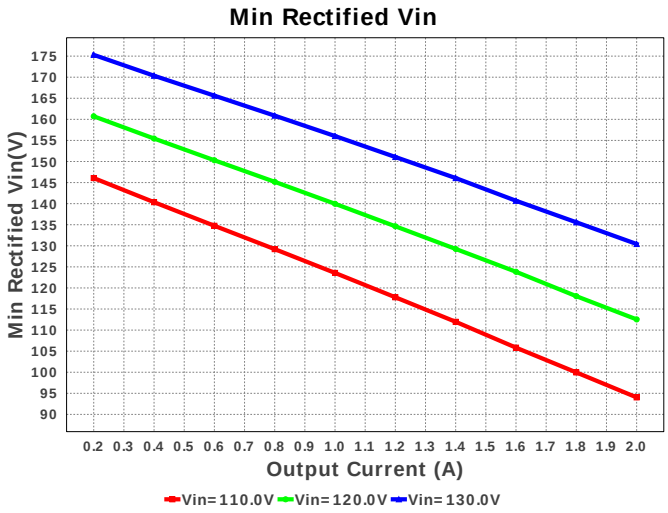


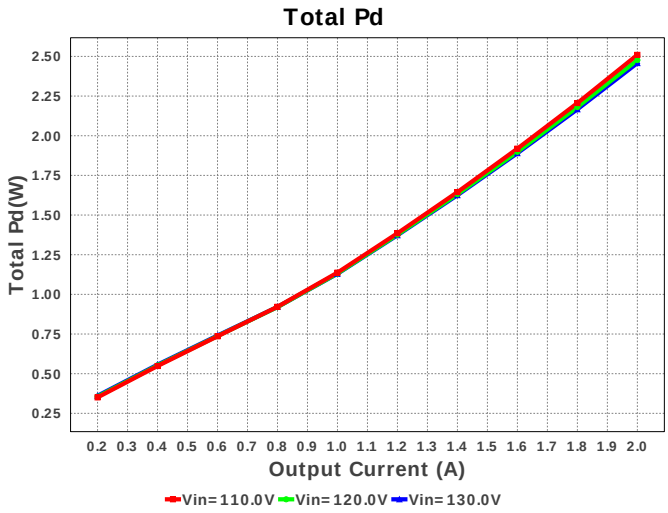


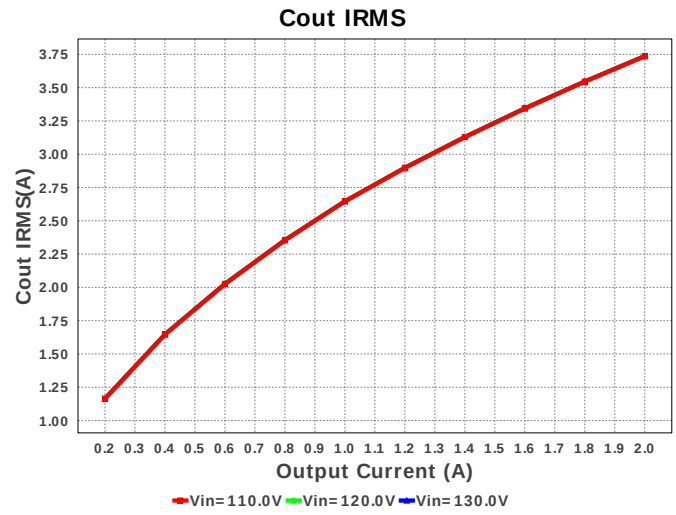


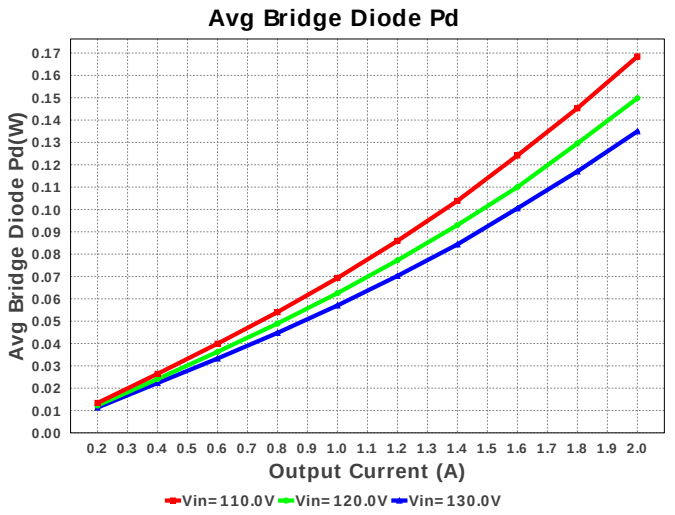


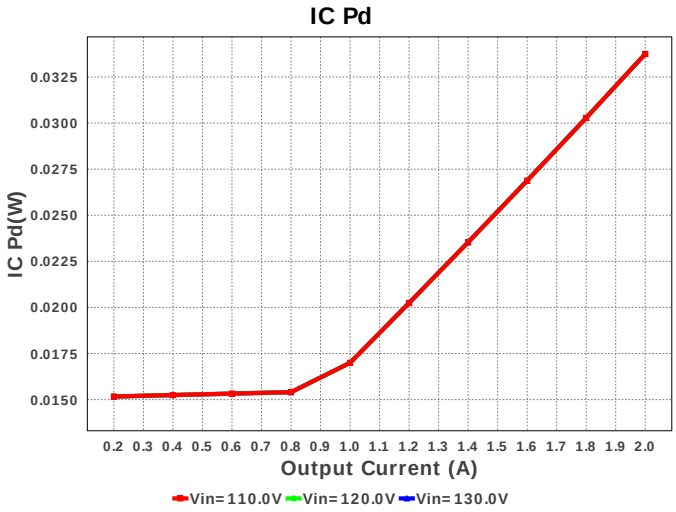


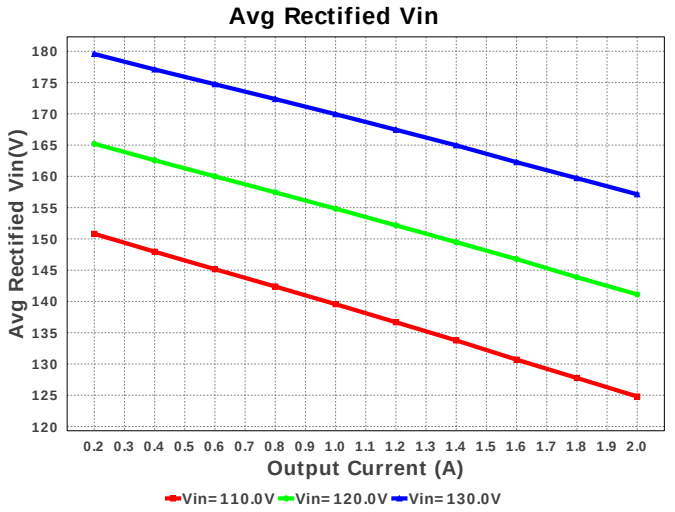


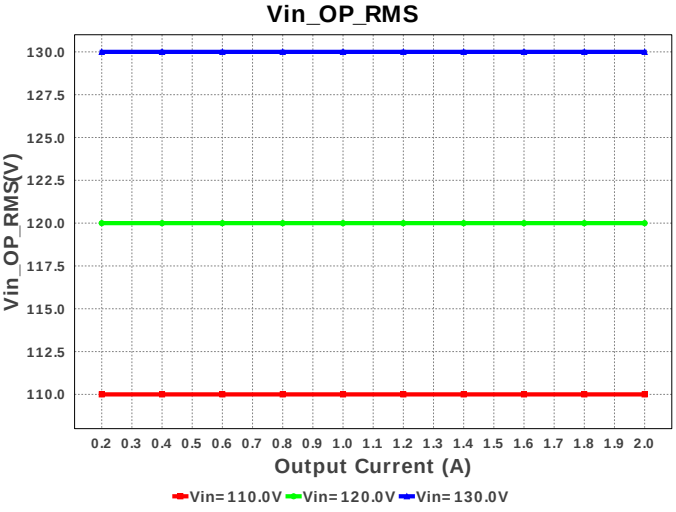


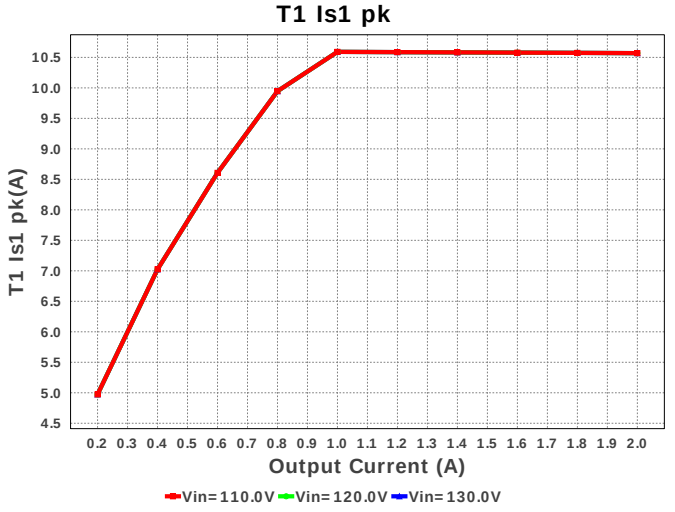


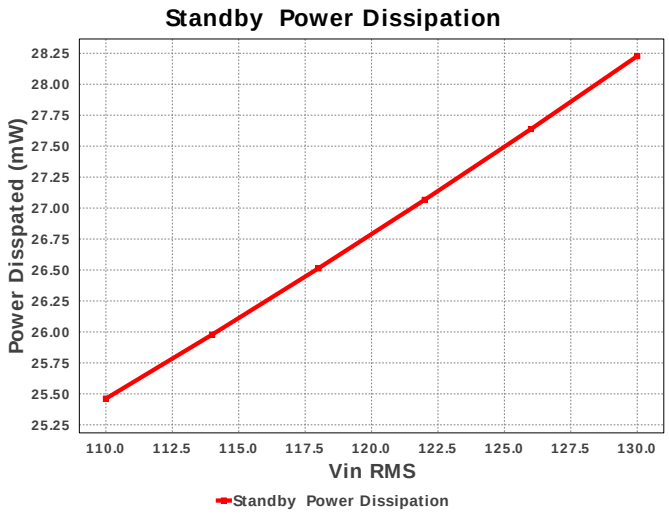


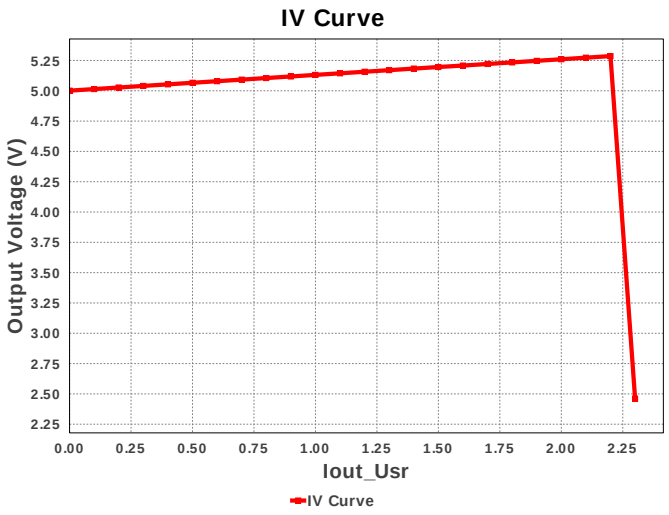












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	86.517 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	252.597 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	3.737 A	Current	Output capacitor RMS ripple current
4.	Iin rms	99.999 mA	Current	RMS Input Current
5.	T1 Iprim RMS	185.981 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	619.835 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	3.756 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	10.57 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	155.961 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	32	General	Total Design BOM count
11.	FootPrint	1.136 k mm^2	General	Total Foot Print Area of BOM components
12.	Pout	10.52 W	General	Total output power
13.	Total BOM	$0.0	General	Total BOM Cost
14.	Vout Actual	5.363 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	5.26 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	27.009 %	Op_point	Duty cycle
17.	Efficiency	80.924 %	Op_point	Steady state efficiency
18.	Frequency_	98.658 kHz	Op_point	Switching frequency
19.	IC Tj	32.362 degC	Op_point	IC junction temperature
20.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	2.0 A	Op_point	Iout operating point
22.	M1 TjOP	41.294 degC	Op_point	M1 MOSFET junction temperature
23.	Min Rectified Vin	128.076 V	Op_point	Minimum voltage seen at rectified input
24.	Peak Rectified Vin	183.846 V	Op_point	Peak voltage seen at rectified input
25.	Vin_OP_RMS	130.0 V	Op_point	AC Input RMS Voltage
26.	Vout p-p	36.995 mV	Op_point	Peak-to-peak output ripple voltage
27.	Avg Bridge Diode Pd	116.637 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
28.	Cin Pd	3.969 mW	Power	Input capacitor power dissipation
29.	Cout Pd	48.876 mW	Power	Output capacitor power dissipation
30.	Diode2 Pd	822.579 mW	Power	Diode2 power dissipation
31.	IC Pd	33.749 mW	Power	IC power dissipation
32.	M1 Pd	180.703 mW	Power	M1 MOSFET total power dissipation
33.	Total Pd	2.48 W	Power	Total Power Dissipation
34.	Xformer Pd	629.77 mW	Power	Transformer power dissipation
35.	Zener Pd	198.916 mW	Power	Zener power dissipation
36.	Vout Tolerance	3.298 %		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	130.0	Maximum input voltage
3.	VinMin	110.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	acFrequency	50.0	Light Output in Lumen
6.	base_pn	UCC28703	Texas Instruments Base Part Number
7.	source	AC	Input Source Type
8.	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. Cdd Cdd supplies the device operating current until the output of the converter reaches the target minimum operating voltage. The value calculated by WEBENCH for Cdd is a good starting point since it assumes that the output current of the Flyback is available to charge the output capacitance until the minimum output voltage is acheived, but may need to be adjusted. 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. UCC28703 Product Folder : http://www.ti.com/product/UCC28703 : contains the data sheet and other resources.