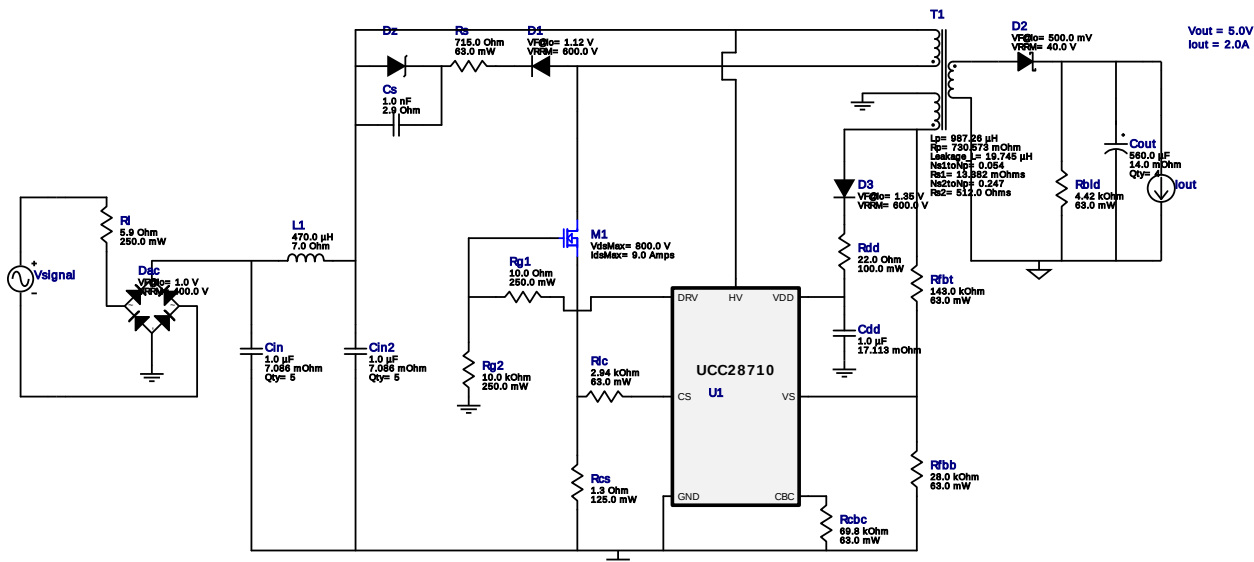


WEBENCH® Design Report

Design : 4108001/12 UCC28710DR
UCC28710DR 110.0V-130.0V to 5.53V @ 2.0A

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

Device = UCC28710DR
Topology = Flyback
Created = 8/22/16 4:34:44 AM
BOM Cost = \$0.00
BOM Count = 36
Total Pd = 1.97W



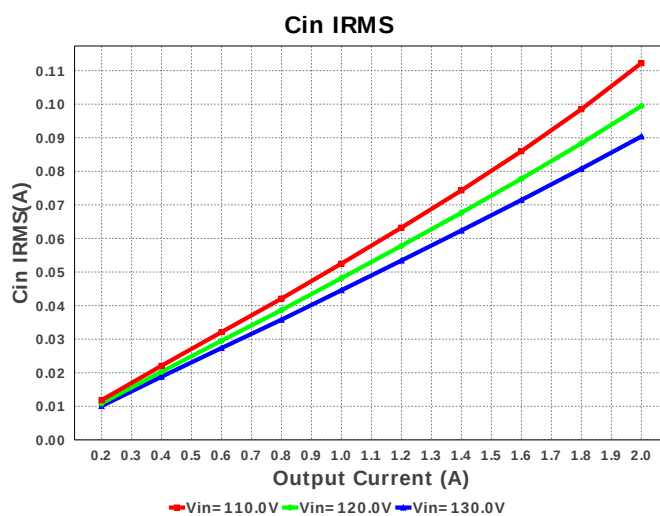
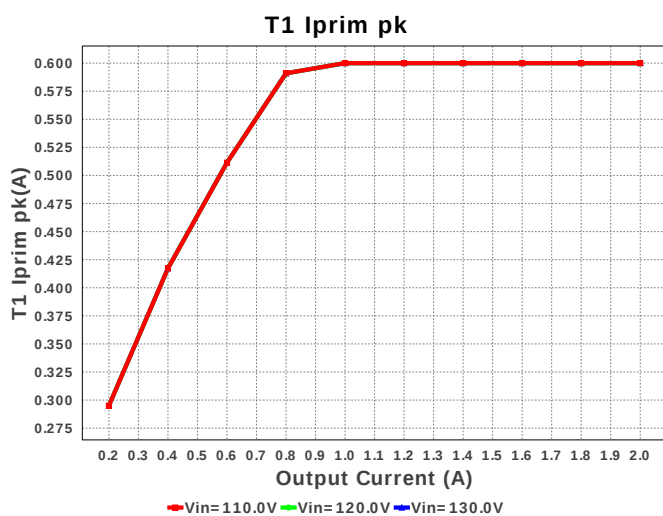
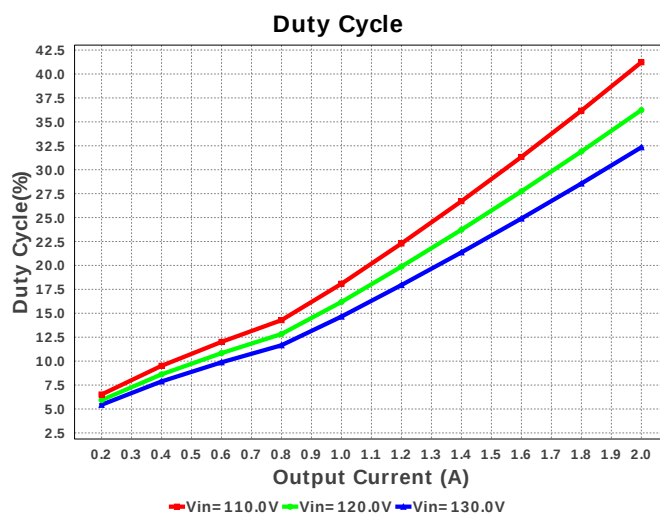
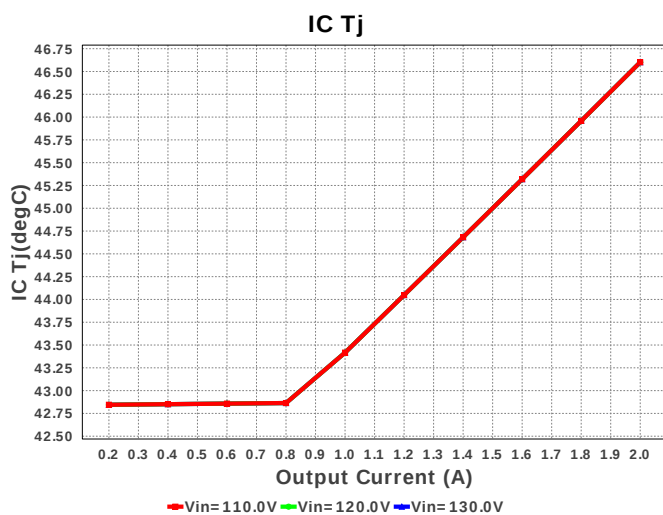
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

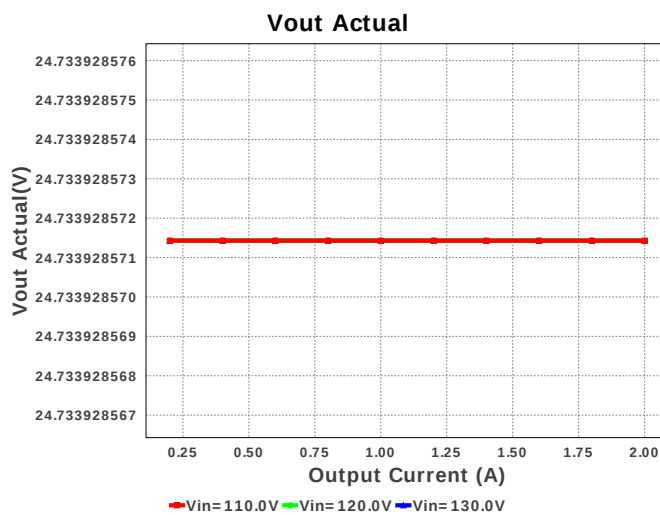
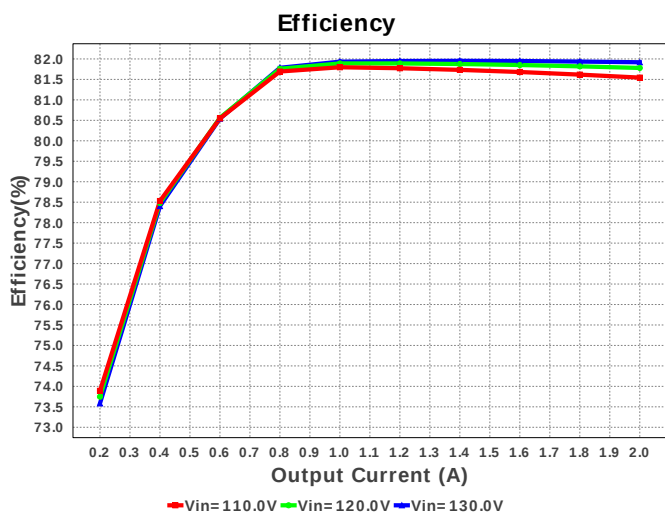
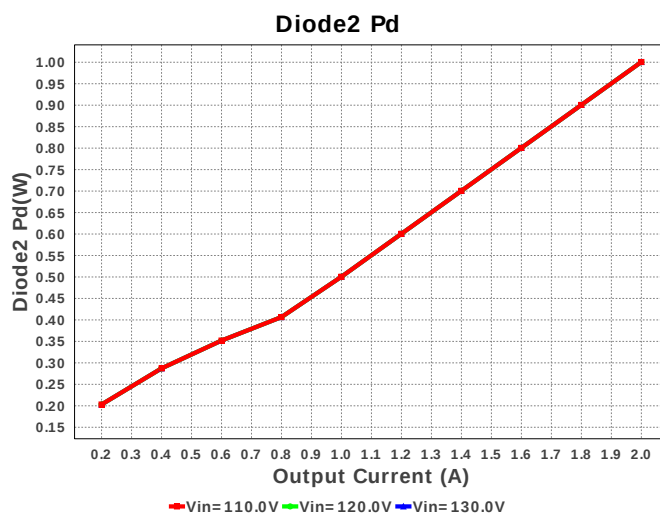
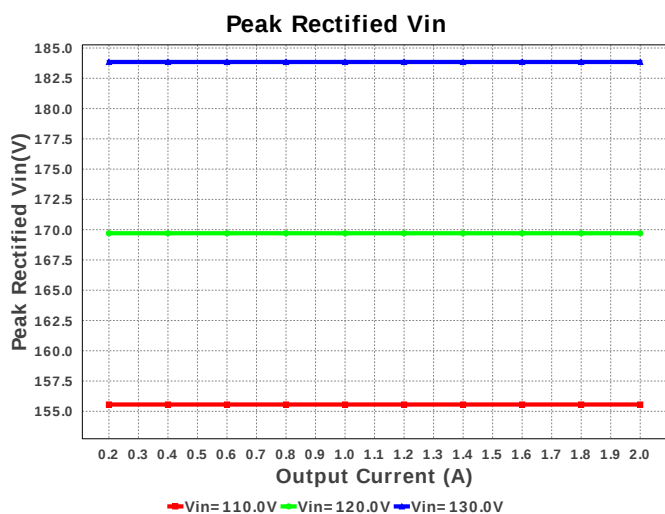
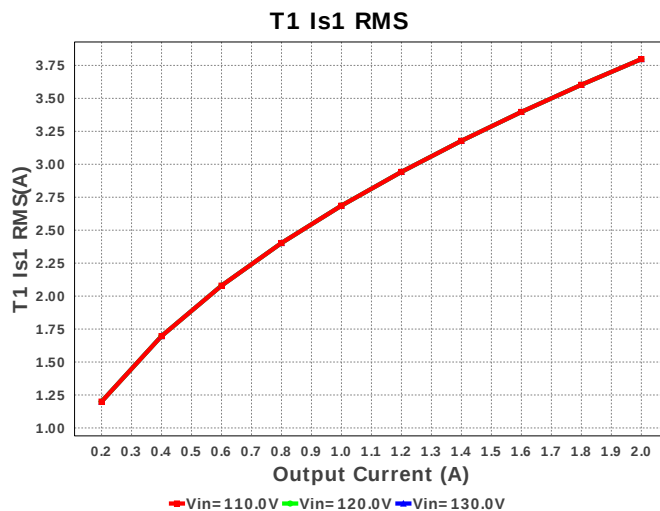
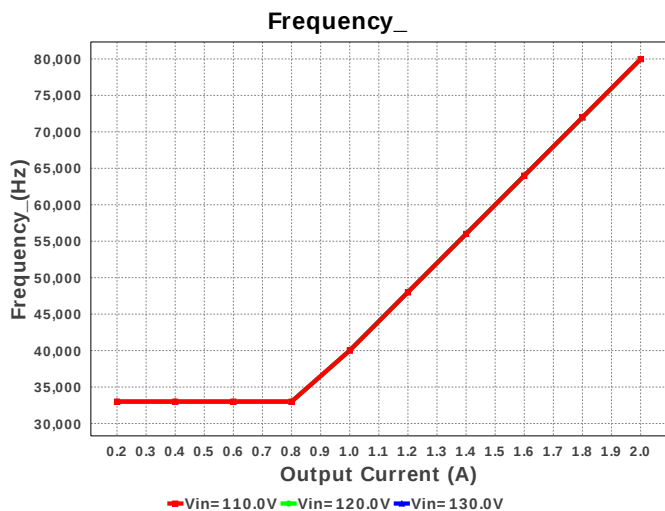
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF ESR= 17.113 mOhm VDC= 25.0 V IRMS= 979.39 mA	1	\$0.01	0603 5 mm ²
2.	Cin	MuRata	GRM55DR72E105KW01L Series= X7R	Cap= 1.0 uF ESR= 7.086 mOhm VDC= 250.0 V IRMS= 2.0605 A	5	\$0.26	2220_200 54 mm ²
3.	Cin2	MuRata	GRM55DR72E105KW01L Series= X7R	Cap= 1.0 uF ESR= 7.086 mOhm VDC= 250.0 V IRMS= 2.0605 A	5	\$0.26	2220_200 54 mm ²
4.	Cout	Panasonic	16SVPF560M Series= ?	Cap= 560.0 uF ESR= 14.0 mOhm VDC= 16.0 V IRMS= 4.95 A	4	\$0.61	CAPSMT_62_E12 106 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	\$0.01	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.	B340-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	\$0.10	SMC 83 mm ²

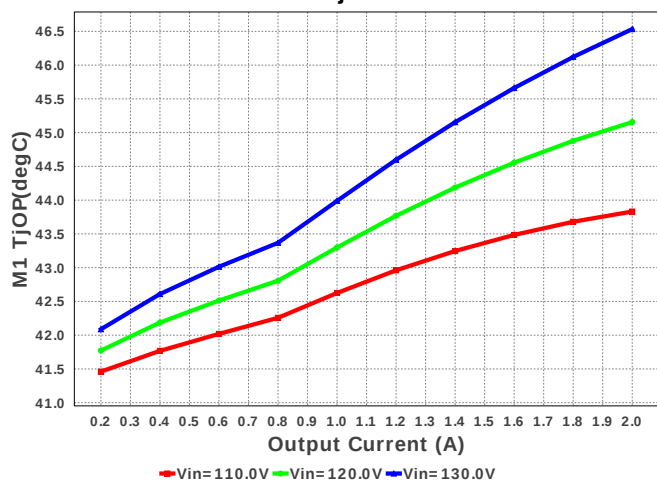
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	D3	Micro Commercial Components	ES1J-TP	VF@Io= 1.35 V VRRM= 600.0 V	1	\$0.08	 SMA 37 mm²
9.	Dac	Diodes Inc.	HD04-T	VF@Io= 1.0 V VRRM= 400.0 V	1	\$0.12	 MiniDIP 62 mm²
10.	Dz	ON Semiconductor	1SMB5951BT3G	Zener	1	\$0.10	 SMB 44 mm²
11.	L1	Bourns	SDR0403-471KL	L= 470.0 µH DCR= 7.0 Ohm	1	\$0.18	 SDR0403 28 mm²
12.	M1	STMicroelectronics	STF10N80K5	VdsMax= 800.0 V IdsMax= 9.0 Amps	1	\$2.52	 TO-220FP 79 mm²
13.	Rbld	Vishay-Dale	CRCW04024K42FKED Series= CRCW..e3	Res= 4.42 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
14.	Rcbc	Vishay-Dale	CRCW040269K8FKED Series= CRCW..e3	Res= 69.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
15.	Rcs	Vishay-Dale	CRCW08051R30FKEA Series= CRCW..e3	Res= 1.3 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm²
16.	Rdd	Yageo America	RC0603FR-0722RL Series= ?	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm²
17.	Rfbb	Vishay-Dale	CRCW040228K0FKED Series= CRCW..e3	Res= 28.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
18.	Rfbd	Vishay-Dale	CRCW0402143KFKED Series= CRCW..e3	Res= 143.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
19.	Rg1	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
20.	Rg2	Panasonic	ERJ-8ENF1002V Series= ERJ-8E	Res= 10.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
21.	RI	Vishay-Dale	CRCW12065R90FKEA Series= CRCW..e3	Res= 5.9 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
22.	Rlc	Vishay-Dale	CRCW04022K94FKED Series= CRCW..e3	Res= 2.94 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
23.	Rs	Vishay-Dale	CRCW0402715RFKED Series= CRCW..e3	Res= 715.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
24.	T1	CUSTOM	CUSTOM	Lp= 987.26 µH Rp= 730.573 mOhm Leakage_L= 19.745 µH Ns1toNp= 0.054 Rs1= 13.382 mOhms Ns2toNp= 0.247 Rs2= 512.0 Ohms	1	NA	CUSTOM 0 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
25.	U1	Texas Instruments	UCC28710DR	Switcher	1	\$0.42	 SOIC-7 0 mm²

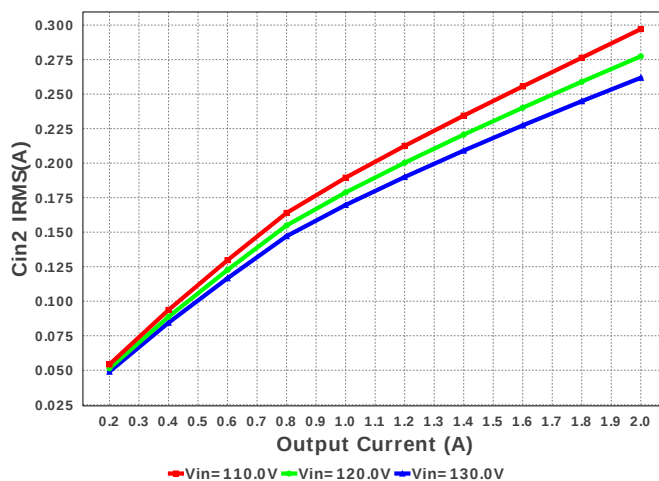




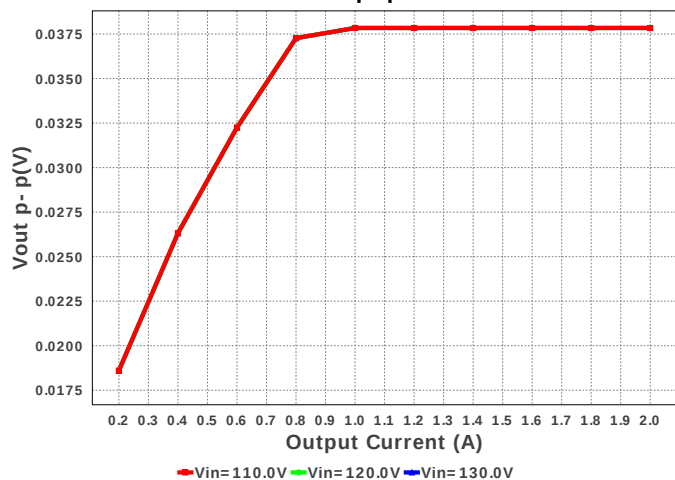
M1 TjOP



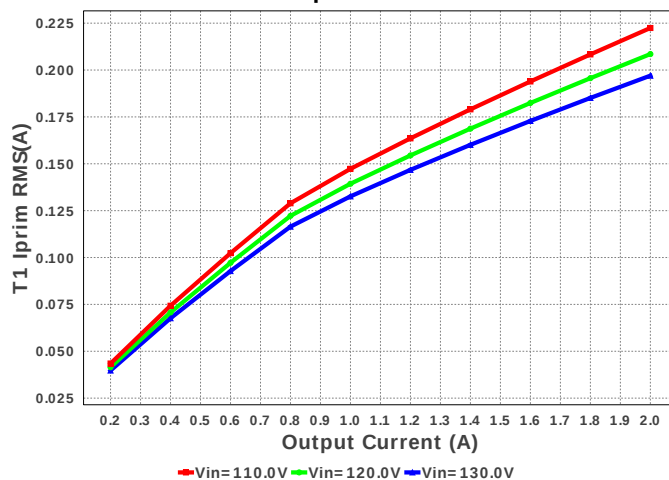
Cin2 IRMS



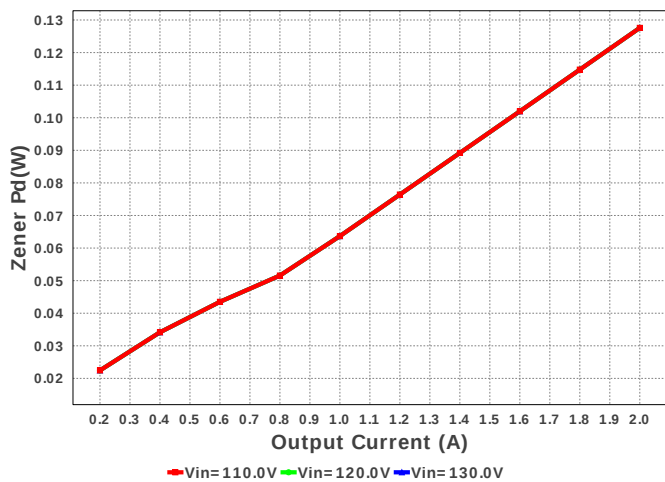
Vout p- p



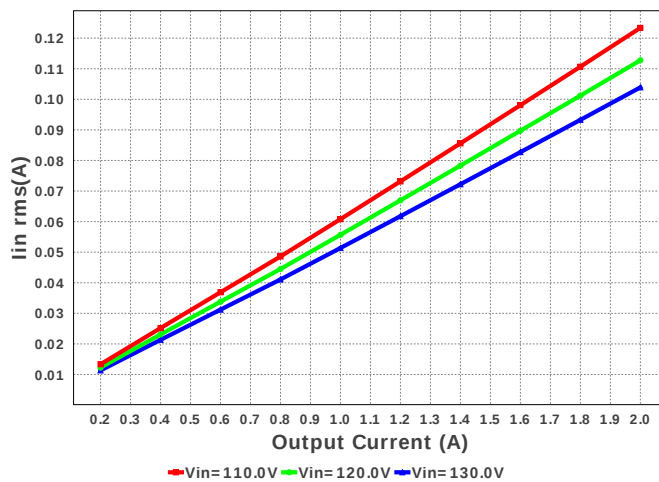
T1 Iprim RMS

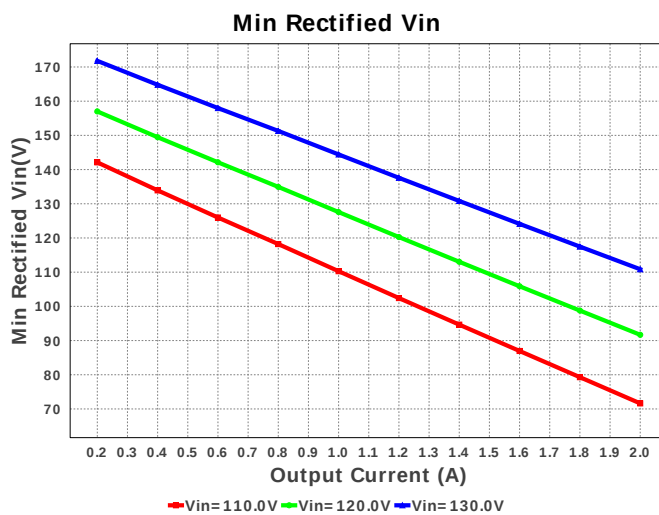
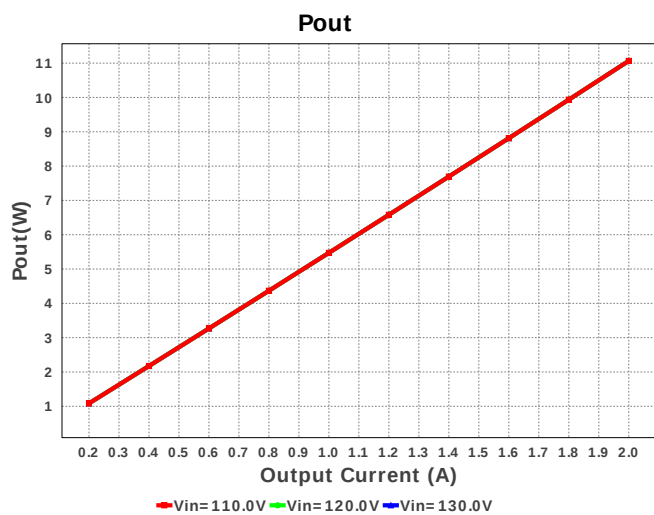
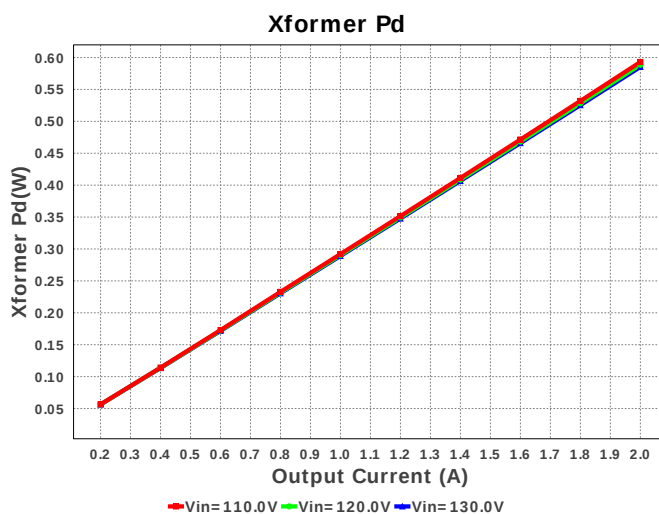
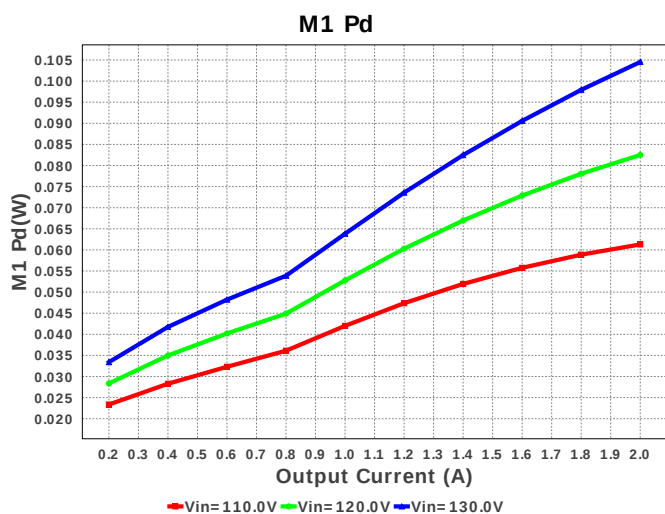
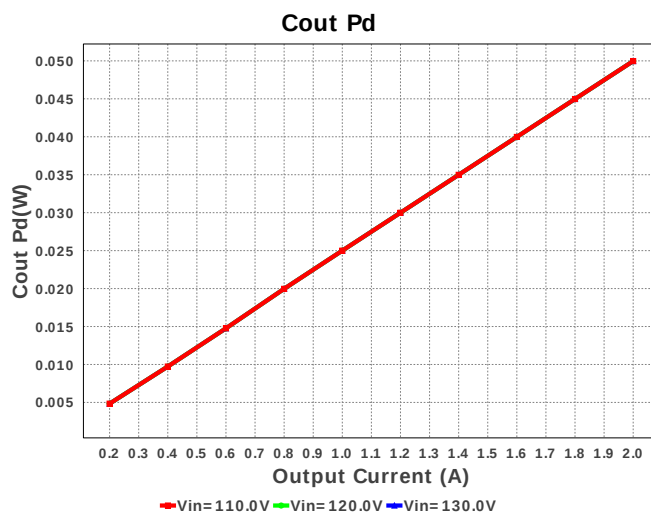
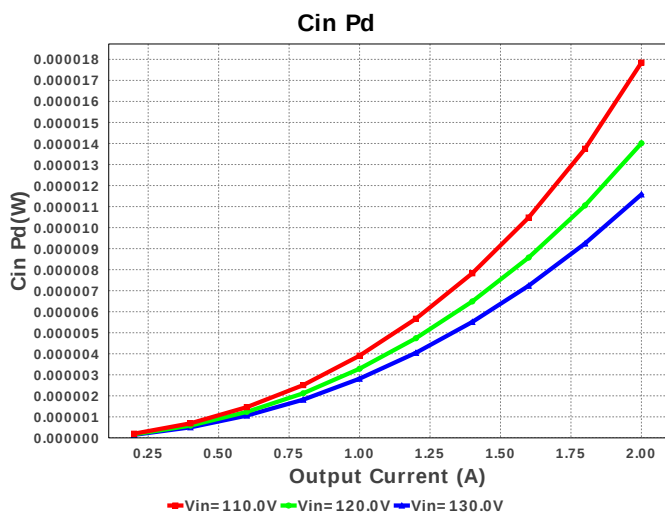


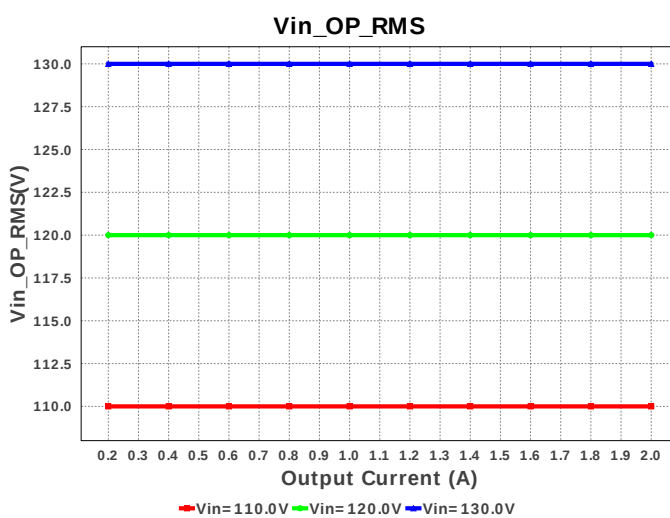
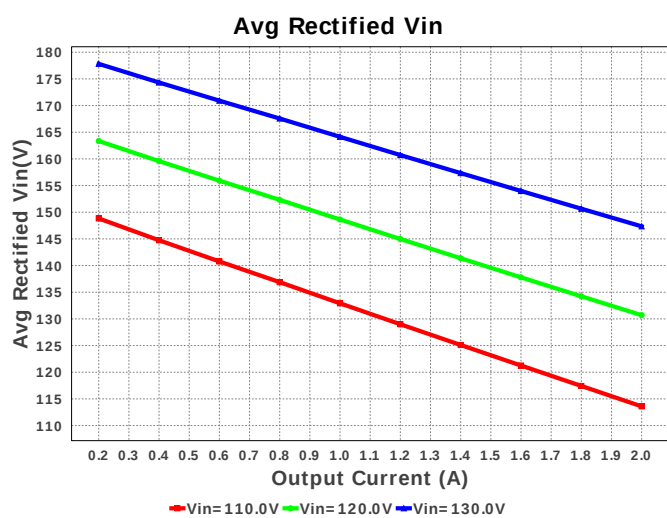
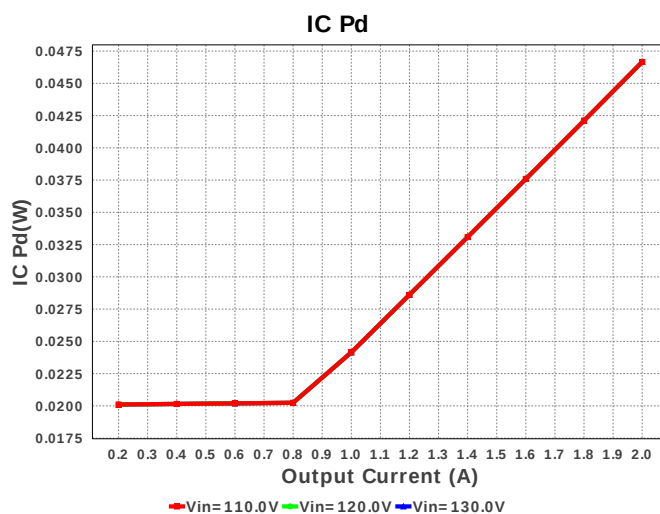
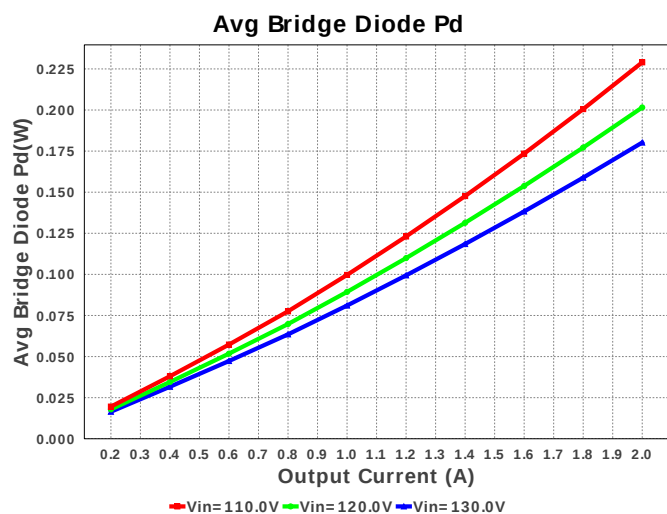
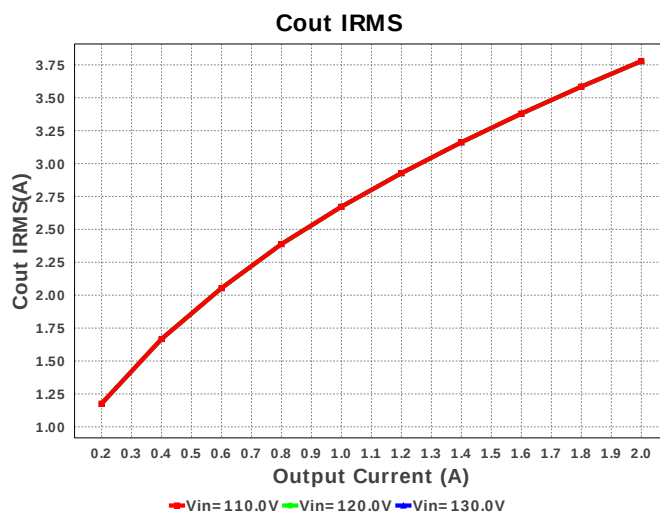
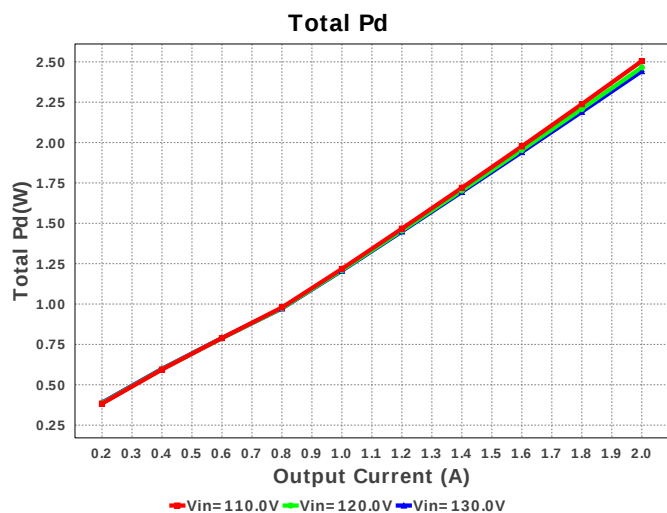
Zener Pd

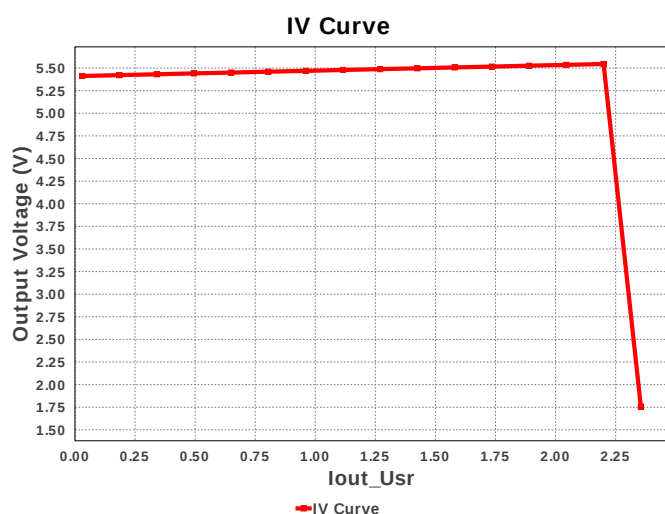
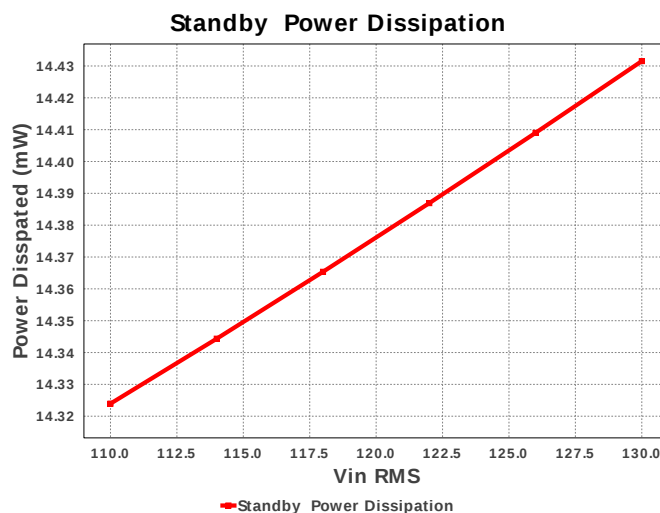
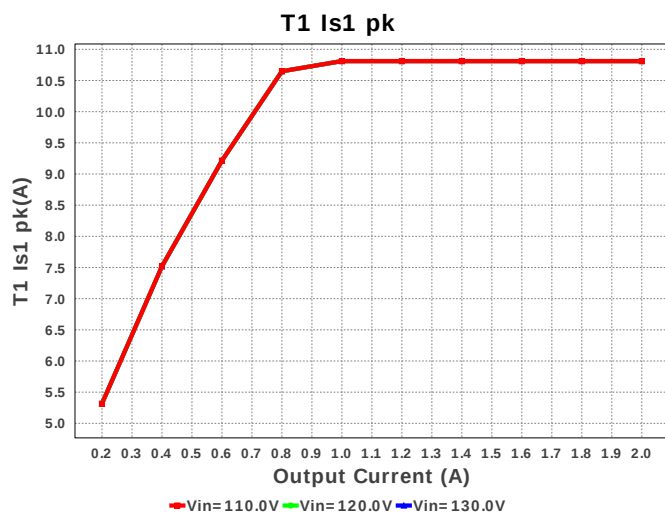


lin rms









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	86.793 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	253.991 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	3.794 A	Current	Output capacitor RMS ripple current
4.	Iin rms	100.25 mA	Current	RMS Input Current
5.	T1 Iprim RMS	190.002 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	600.0 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	3.814 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	10.901 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	154.411 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	36	General	Total Design BOM count
11.	FootPrint	1.482 k mm ²	General	Total Foot Print Area of BOM components
12.	Mode	DCM	General	Conduction Mode
13.	Pout	11.062 W	General	Total output power
14.	Total BOM	\$0.0	General	Total BOM Cost
15.	Vout Actual	24.734 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Vout OP	5.531 V	Op_Point	Operational Output Voltage
17.	Duty Cycle	30.084 %	Op_point	Duty cycle
18.	Efficiency	84.883 %	Op_point	Steady state efficiency
19.	Frequency_	77.506 kHz	Op_point	Switching frequency
20.	IC Tj	43.168 degC	Op_point	IC junction temperature
21.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
22.	IOUT_OP	2.0 A	Op_point	Iout operating point
23.	M1 TJOP	47.003 degC	Op_point	M1 MOSFET junction temperature
24.	Min Rectified Vin	124.976 V	Op_point	Minimum voltage seen at rectified input
25.	Peak Rectified Vin	183.846 V	Op_point	Peak voltage seen at rectified input
26.	Vin_OP_RMS	130.0 V	Op_point	AC Input RMS Voltage
27.	Vout p-p	38.153 mV	Op_point	Peak-to-peak output ripple voltage
28.	Avg Bridge Diode Pd	118.275 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
29.	Cin Pd	10.676 μW	Power	Input capacitor power dissipation
30.	Cout Pd	50.384 mW	Power	Output capacitor power dissipation
31.	Diode2 Pd	821.81 mW	Power	Diode2 power dissipation

#	Name	Value	Category	Description
32.	IC Pd	45.263 mW	Power	IC power dissipation
33.	M1 Pd	112.04 mW	Power	M1 MOSFET total power dissipation
34.	Total Pd	1.97 W	Power	Total Power Dissipation
35.	Xformer Pd	579.266 mW	Power	Transformer power dissipation
36.	Zener Pd	33.872 mW	Power	Zener power dissipation
37.	Vout Tolerance	2.694 %		Vout Tolerance based on IC Tolerance (no load) 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	60.0	Light Output in Lumen
6.	base_pn	UCC28710	Texas Instruments Base Part Number
7.	source	AC	Input Source Type
8.	ta	40.0	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 achieved, but may need to be adjusted. 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.

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