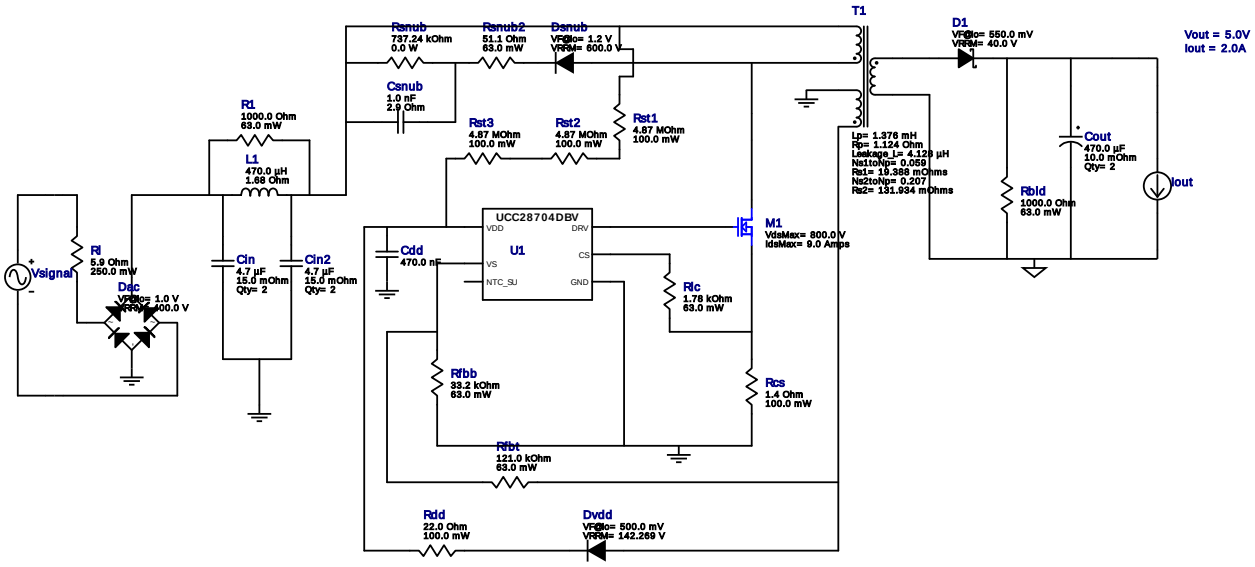
VinMin = 110.0V
VinMax = 130.0V
Vout = 5.0V
Iout = 2.0A

Device = UCC28704DBVR-1
Topology = Flyback
Created = 8/9/16 2:07:52 AM
BOM Cost = $0.00
BOM Count = 29
Total Pd = 2.23W

WEBENCH® Design Report

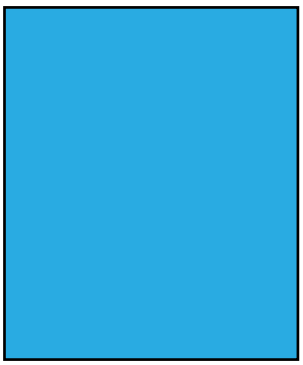
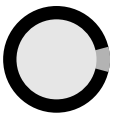
Design : 4352199/78 UCC28704DBVR-1
UCC28704DBVR-1 110.0V-130.0V to 5.67V @ 2.0A



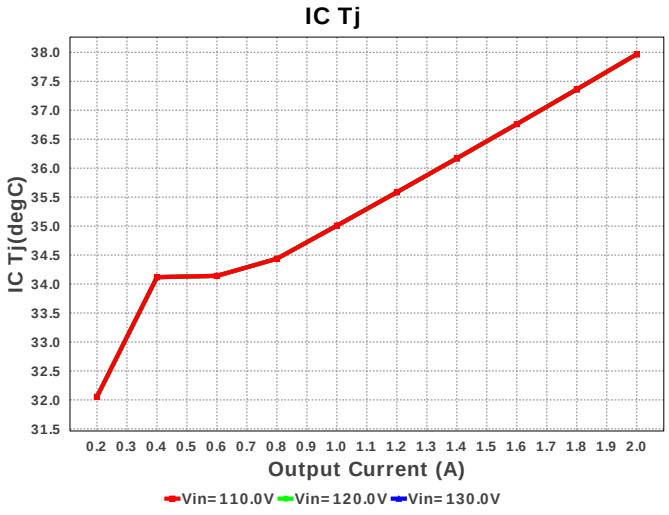
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

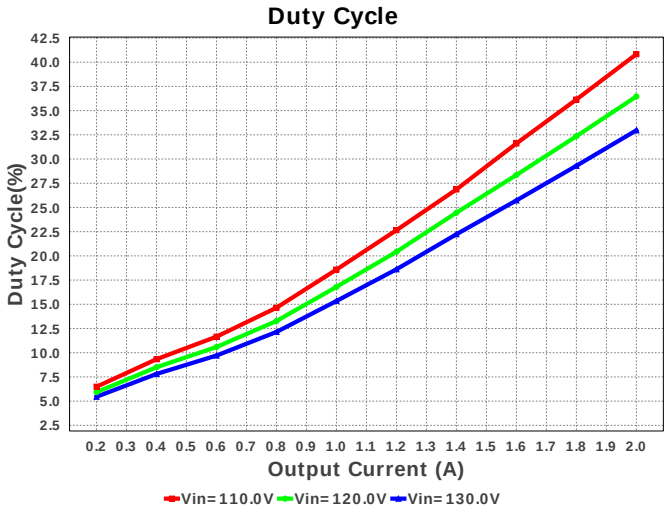
Electrical BOM

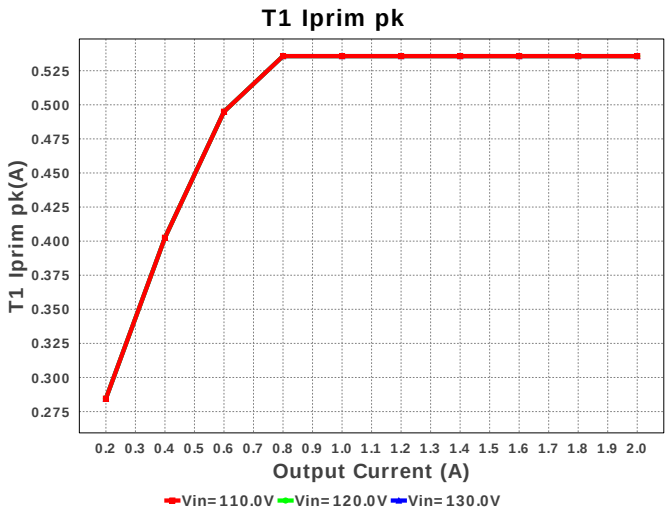
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	Taiyo Yuden	TMK212BJ474KD-T Series= X5R	Cap= 470.0 nF VDC= 20.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm^2
2.	Cin	TDK	B32924C3475M Series= B32924	Cap= 4.7 uF ESR= 15.0 mOhm VDC= 630.0 V IRMS= 457.0 mA	2	$1.11	B32924_33mm 670 mm^2

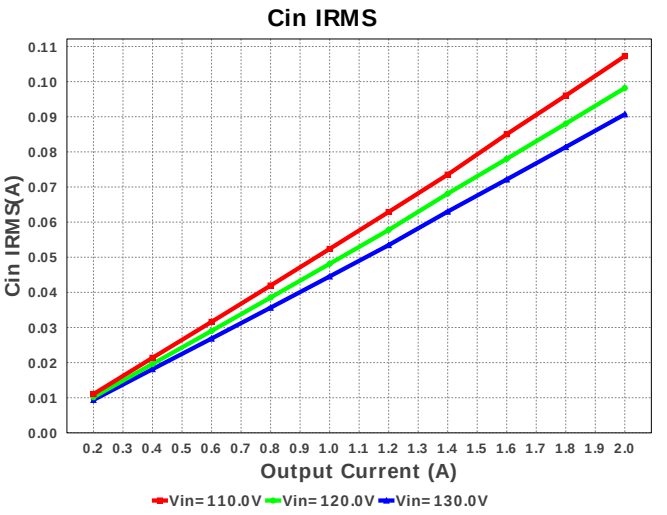
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
3.	Cin2	TDK	B32924C3475M Series= B32924	Cap= 4.7 uF ESR= 15.0 mOhm VDC= 630.0 V IRMS= 457.0 mA	2	$1.11	 B32924_33mm 670 mm^2
4.	Cout	Nichicon	RNU1C471MDN1PH Series= ?	Cap= 470.0 uF ESR= 10.0 mOhm VDC= 16.0 V IRMS= 6.1 A	2	$0.52	 NU_1000x1250 144 mm^2
5.	Csnub	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	Diodes Inc.	B540C-13-F	VF@Io= 550.0 mV VRRM= 40.0 V	1	$0.17	 SMC 83 mm^2
7.	Dac	Diodes Inc.	HD04-T	VF@Io= 1.0 V VRRM= 400.0 V	1	$0.12	 MiniDIP 62 mm^2
8.	Dsnub	Bourns	CD214B-F3600	VF@Io= 1.2 V VRRM= 600.0 V	1	$0.14	 SMB 44 mm^2
9.	Dvdd	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 142.269 V	1	NA	CUSTOM 0 mm^2
10.	L1	Panasonic	ELL-6UH471M	L= 470.0 µH DCR= 1.68 Ohm	1	$0.28	 ELL6UH 67 mm^2
11.	M1	STMicroelectronics	STF10N80K5	VdsMax= 800.0 V IdsMax= 9.0 Amps	1	$2.52	 TO-220FP 79 mm^2
12.	R1	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
13.	Rbld	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
14.	Rcs	Vishay-Dale	CRCW06031R40FKEA Series= CRCW..e3	Res= 1.4 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 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	CRCW040233K2FKED Series= CRCW..e3	Res= 33.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
17.	Rfbt	Vishay-Dale	CRCW0402121KFKED Series= CRCW..e3	Res= 121.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2

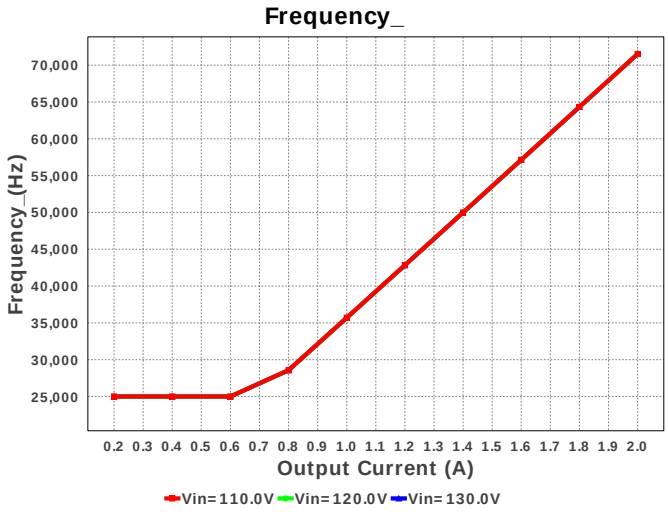
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
18.	Rl	Vishay-Dale	CRCW12065R90FKEA Series= CRCW..e3	Res= 5.9 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm²
19.	Rlc	Vishay-Dale	CRCW04021K78FKED Series= CRCW..e3	Res= 1.78 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
20.	Rsnub	CUSTOM	CUSTOM Series= ?	Res= 737.24 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm²
21.	Rsnub2	Vishay-Dale	CRCW040251R1FKED Series= CRCW..e3	Res= 51.1 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
22.	Rst1	Vishay-Dale	CRCW06034M87FKEA Series= CRCW..e3	Res= 4.87 MOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
23.	Rst2	Vishay-Dale	CRCW06034M87FKEA Series= CRCW..e3	Res= 4.87 MOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
24.	Rst3	Vishay-Dale	CRCW06034M87FKEA Series= CRCW..e3	Res= 4.87 MOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
25.	T1	CUSTOM	CUSTOM	Lp= 1.376 mH Rp= 1.124 Ohm Leakage_L= 4.128 µH Ns1toNp= 0.059 Rs1= 19.388 mOhms Ns2toNp= 0.207 Rs2= 131.934 mOhms	1	NA	CUSTOM 0 mm²
26.	U1	Texas Instruments	UCC28704DBVR-1	Switcher	1	$0.30	SOT-23-6 15 mm²

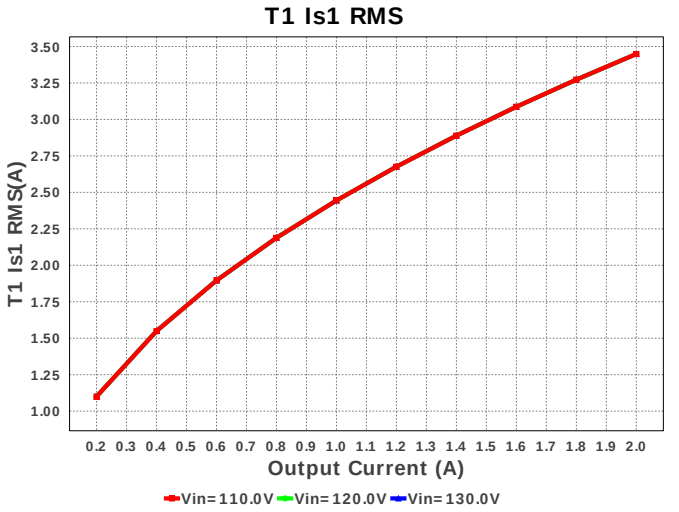


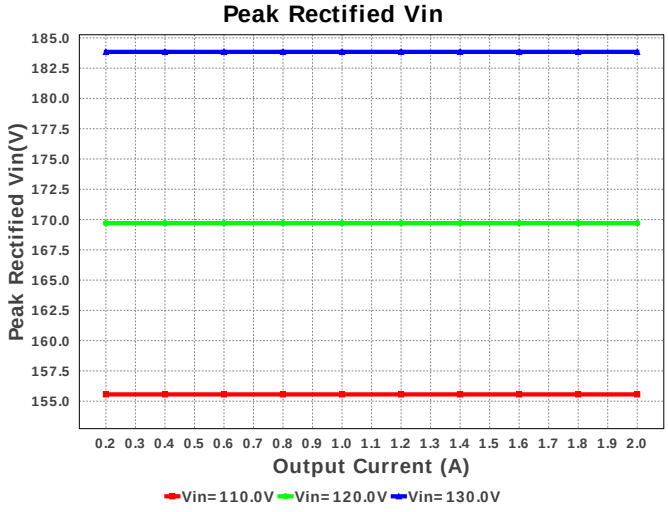


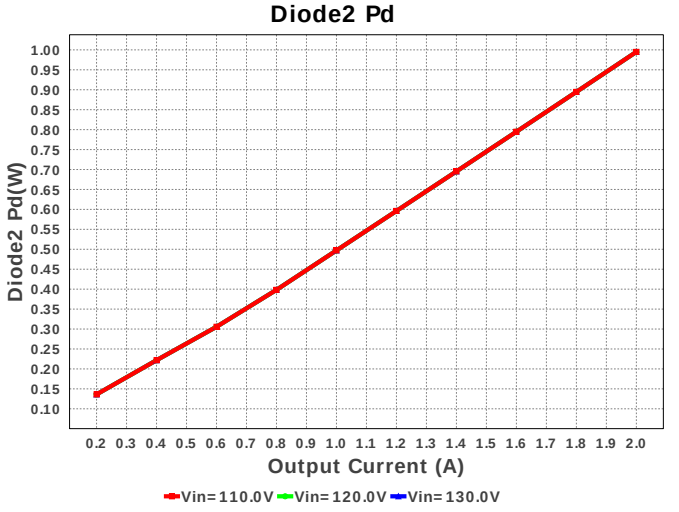




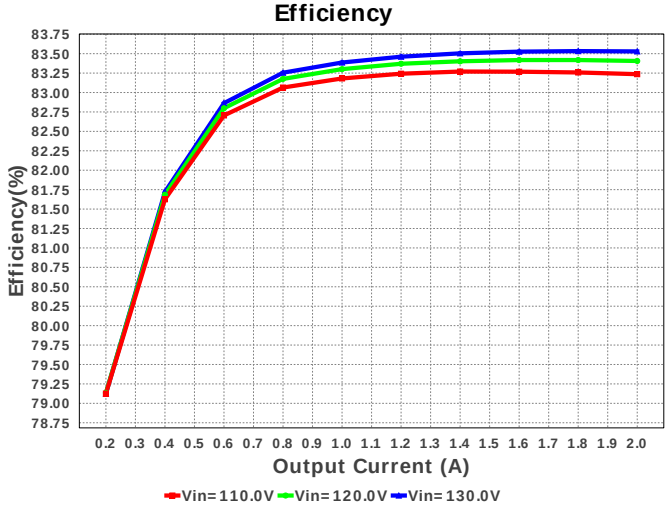




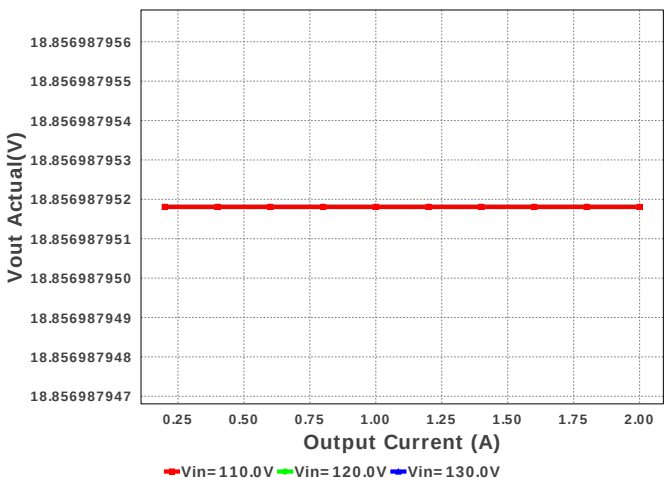




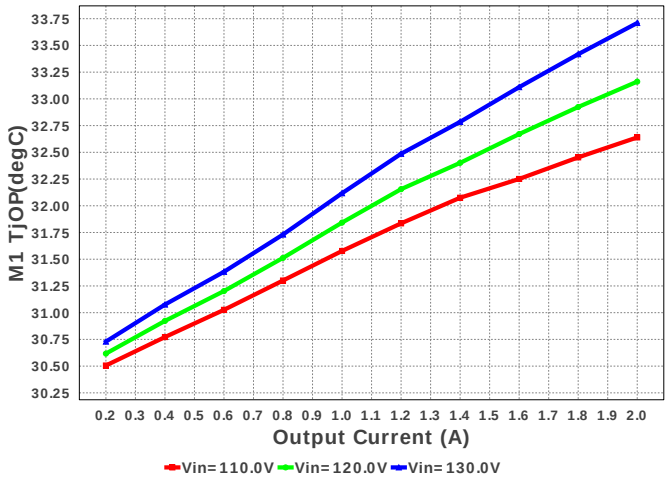
Efficiency



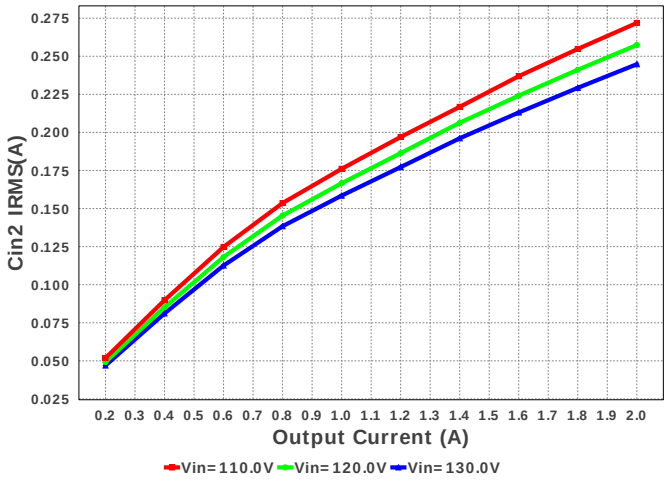
Vout Actual



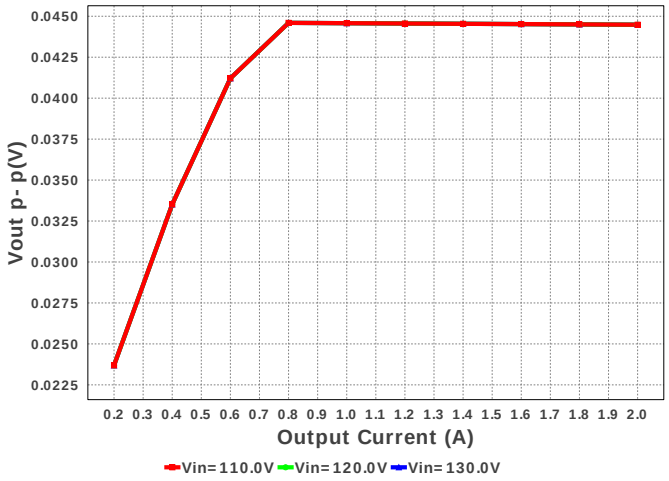
M1 TjOP



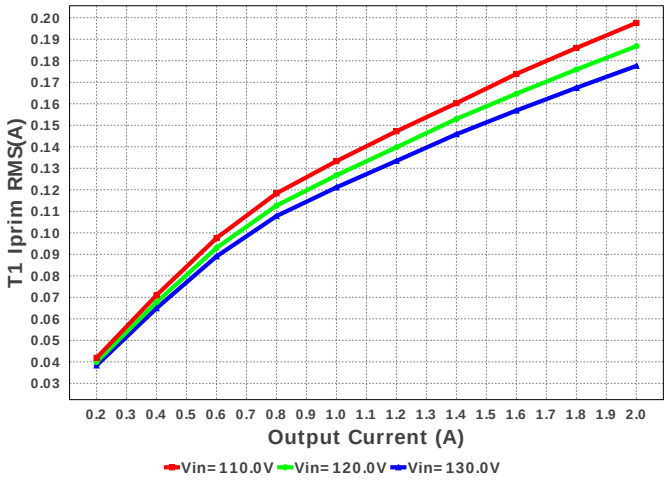
Cin2 IRMS

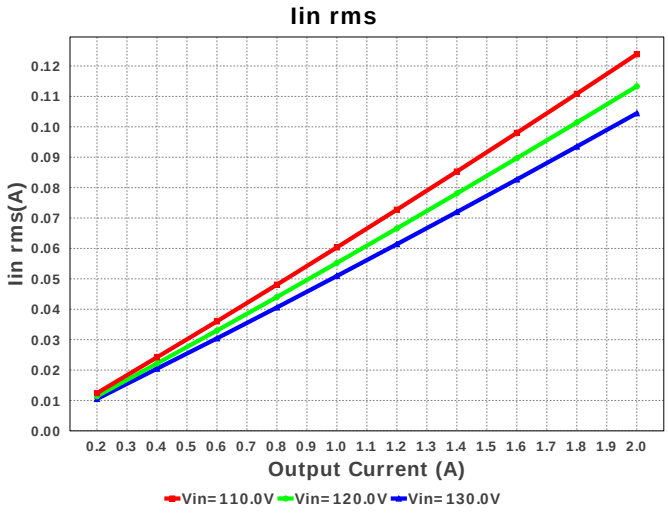


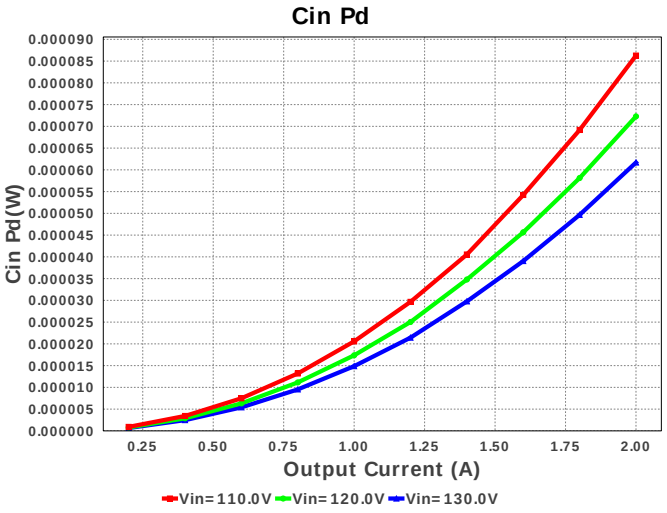
Vout p- p

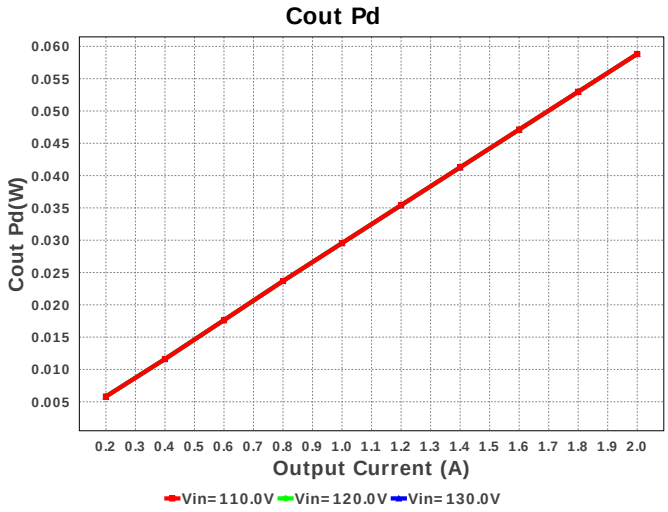


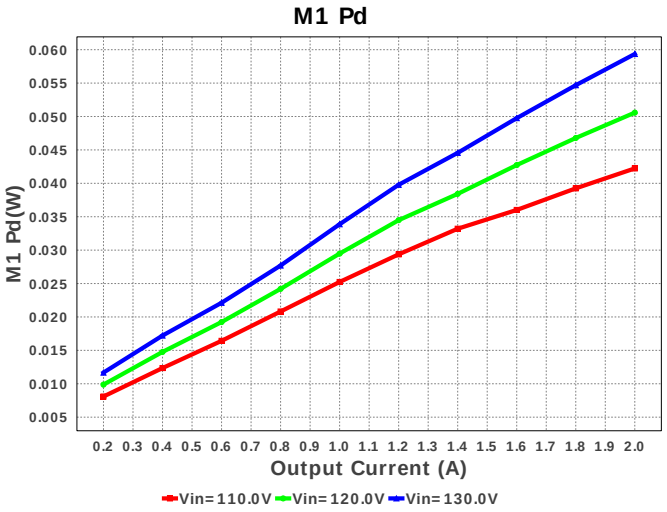
T1 Iprim RMS

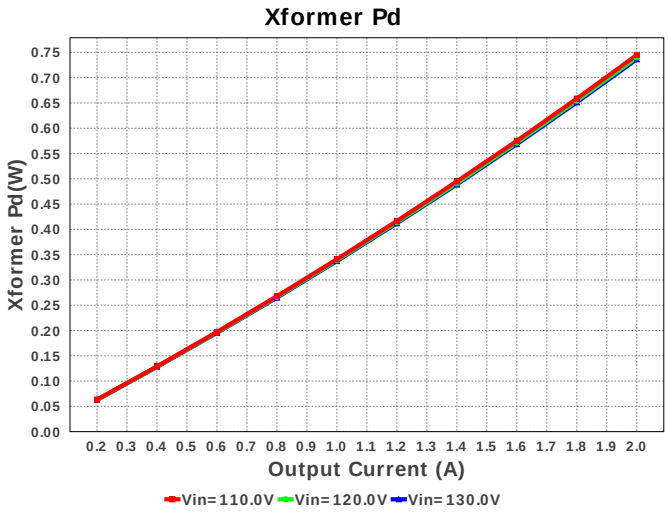


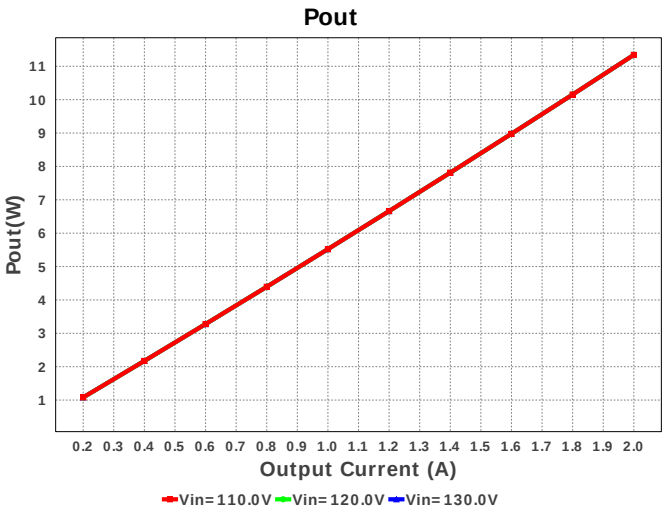


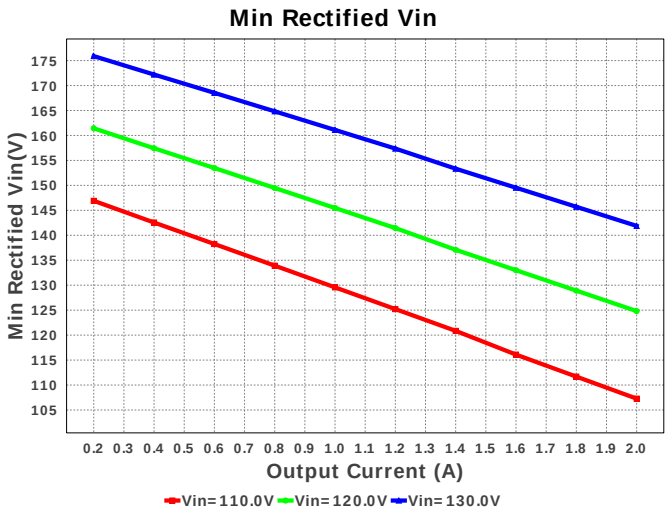


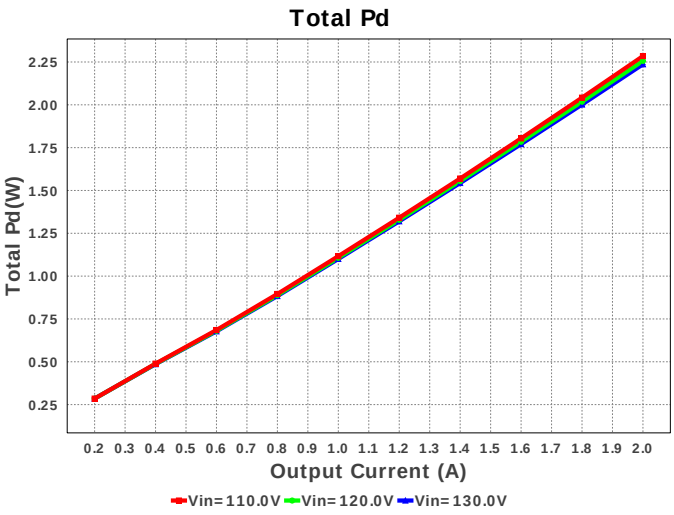


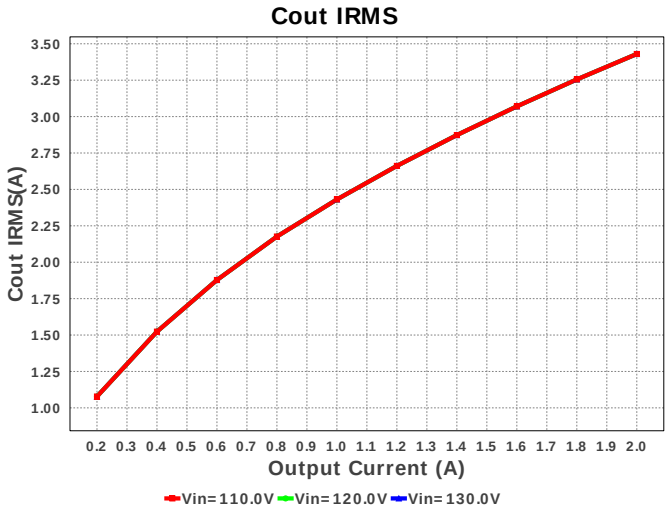


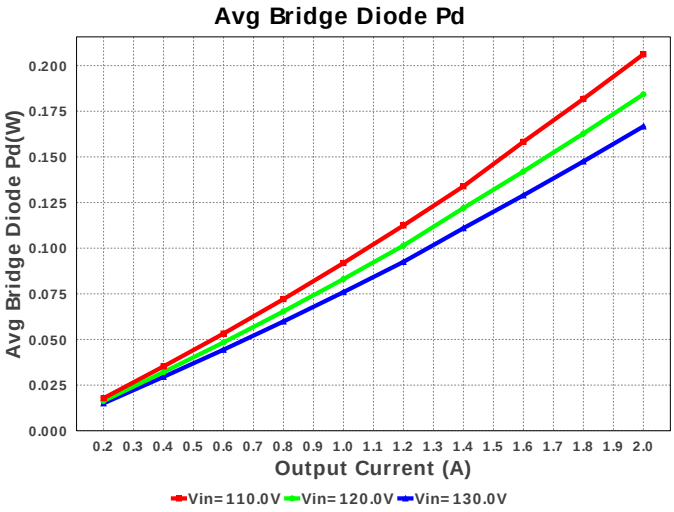


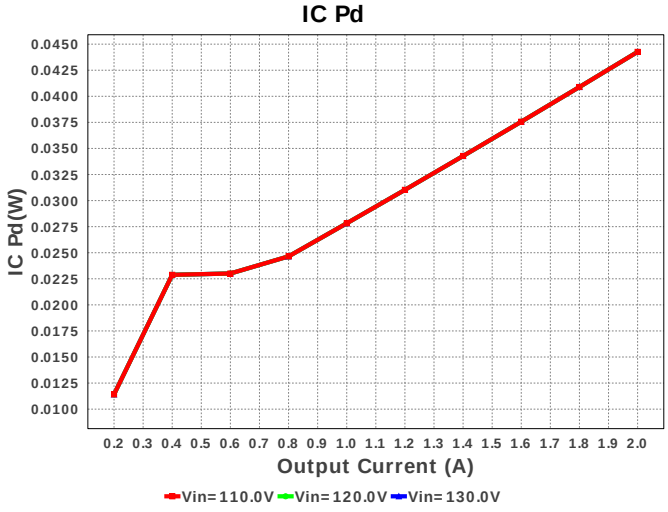


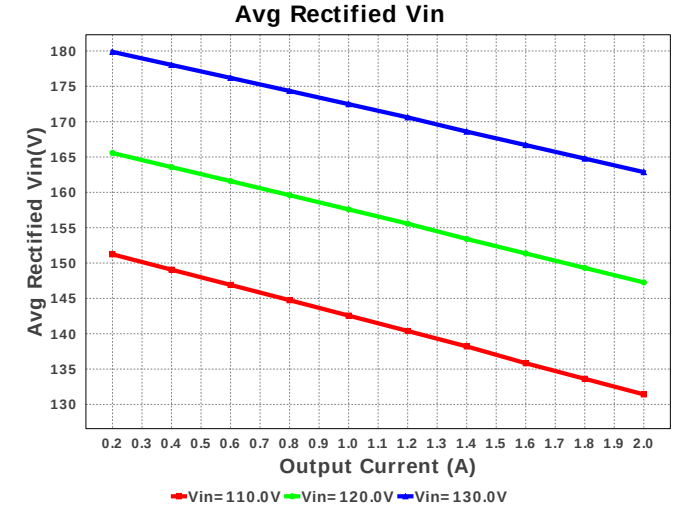


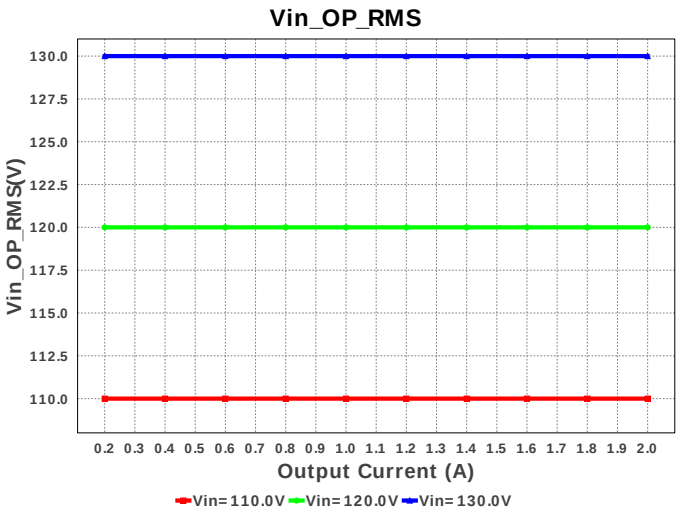


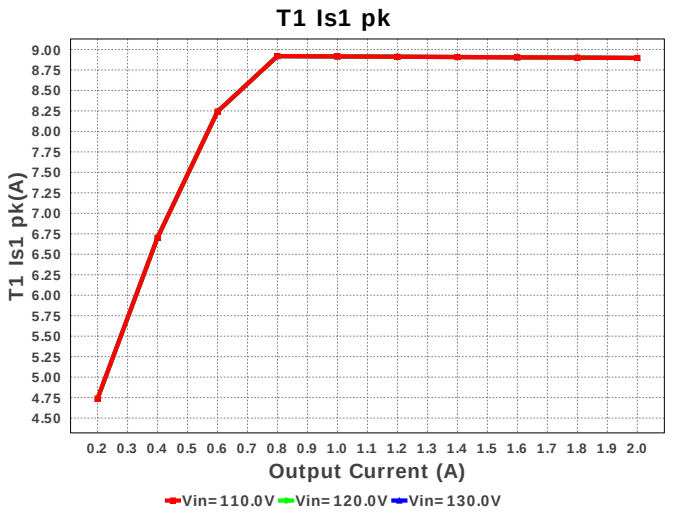


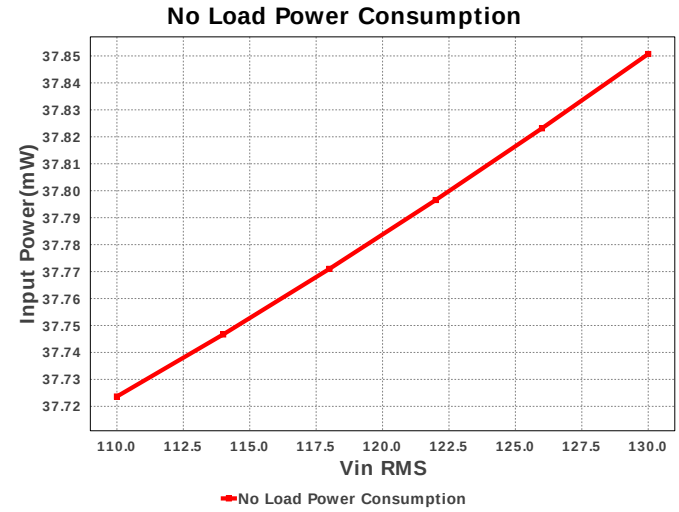


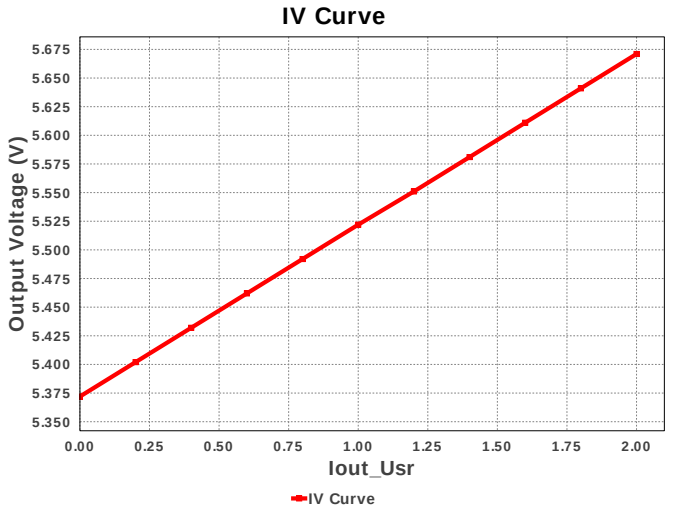












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	91.076 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	245.109 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	3.43 A	Current	Output capacitor RMS ripple current
4.	Iin rms	104.38 mA	Current	RMS Input Current
5.	T1 Iprim RMS	177.512 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	535.714 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	3.449 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	8.897 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	163.046 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	29	General	Total Design BOM count
11.	FootPrint	3.398 k mm^2	General	Total Foot Print Area of BOM components
12.	Pout	11.342 W	General	Total output power
13.	Total BOM	$0.0	General	Total BOM Cost
14.	Vout Actual	18.857 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Duty Cycle	32.939 %	Op_point	Duty cycle
16.	Efficiency	83.583 %	Op_point	Steady state efficiency
17.	Frequency_	71.52 kHz	Op_point	Switching frequency
18.	IC Tj	33.098 degC	Op_point	IC junction temperature
19.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	2.0 A	Op_point	Iout operating point
21.	M1 TjOP	33.714 degC	Op_point	M1 MOSFET junction temperature
22.	Min Rectified Vin	142.246 V	Op_point	Minimum voltage seen at rectified input
23.	Peak Rectified Vin	183.846 V	Op_point	Peak voltage seen at rectified input
24.	Vin_OP_RMS	130.0 V	Op_point	AC Input RMS Voltage
25.	Vout p-p	44.483 mV	Op_point	Peak-to-peak output ripple voltage
26.	Avg Bridge Diode Pd	117.01 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
27.	Cin Pd	62.211 µW	Power	Input capacitor power dissipation
28.	Cout Pd	58.822 mW	Power	Output capacitor power dissipation
29.	Diode2 Pd	994.982 mW	Power	Diode2 power dissipation
30.	IC Pd	44.26 mW	Power	IC power dissipation
31.	M1 Pd	59.431 mW	Power	M1 MOSFET total power dissipation

#	Name	Value	Category	Description
32.	Total Pd	2.228 W	Power	Total Power Dissipation
33.	Xformer Pd	736.405 mW	Power	Transformer power dissipation
34.	Vout Tolerance	1.785 %		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	50.0	Light Output in Lumen
6.	base_pn	UCC28704	Texas Instruments Base Part Number
7.	source	AC	Input Source Type
8.	ta	30.0	Ambient temperature

Design Assistance

1. Application Hints: T1: The transformer parameters assume that an RM6 core is used, and the DCR values are assumed values used only for efficiency estimates. 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 UCC28704 Flyback power supply controller 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/ucc28704.pdf

2. UCC28704 Product Folder : http://www.ti.com/product/UCC28704 : contains the data sheet and other resources.