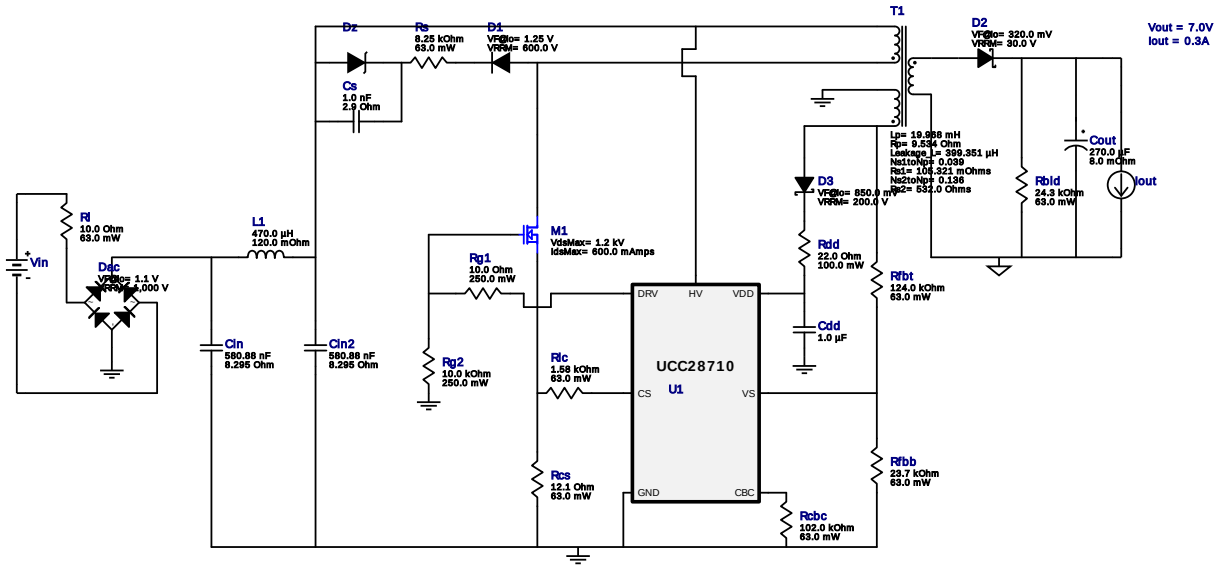
WEBENCH® Design Report

VinMin = 170.0V
VinMax = 270.0V
Vout = 7.0V
Iout = 0.3A

Device = UCC28710DR
Topology = Flyback
Created = 9/8/16 11:21:42 PM
BOM Cost = $0.00
BOM Count = 25
Total Pd = 0.26W

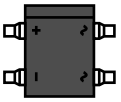
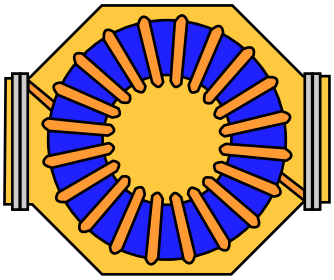
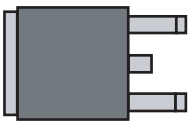
Design : 4551144/148 UCC28710DR
UCC28710DR 170.0V-270.0V to 7.33V @ 0.3A



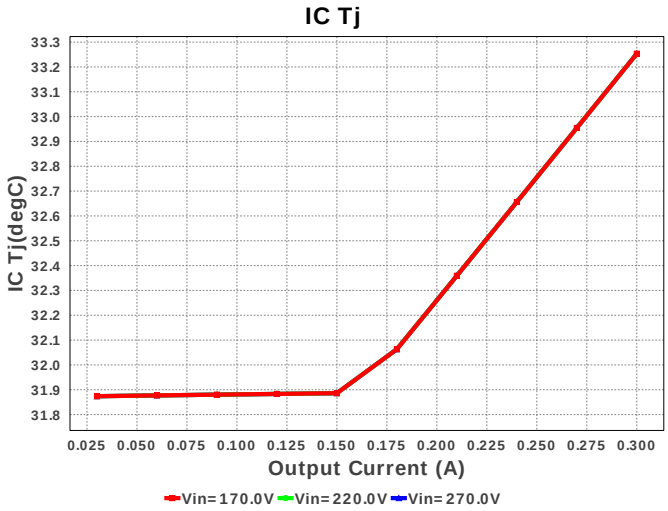
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

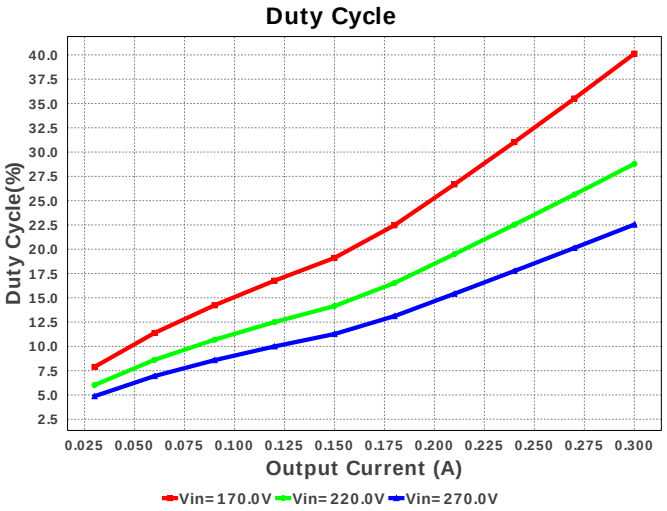
Electrical BOM

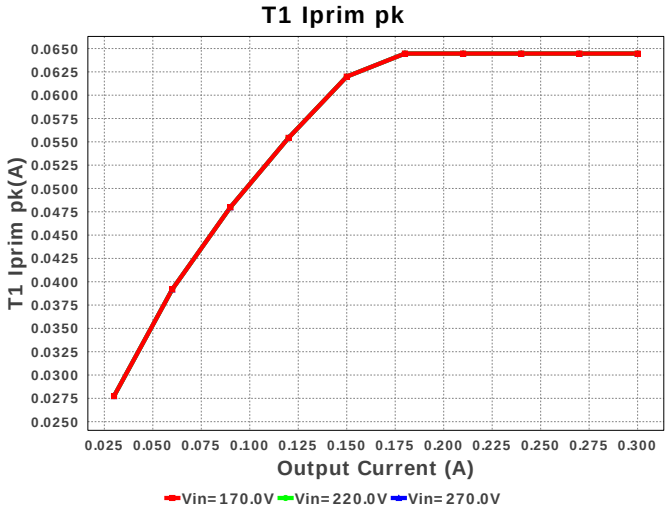
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 35.0 V IRMS= 0.0 A	1	$0.05	0805 7 mm²
2.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 580.88 nF ESR= 8.2951 Ohm VDC= 572.75 V IRMS= 49.098 mA	1	NA	CUSTOM 0 mm²
3.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 580.88 nF ESR= 8.2951 Ohm VDC= 572.75 V IRMS= 49.098 mA	1	NA	CUSTOM 0 mm²
4.	Cout	Panasonic	16SVPG270M Series= ?	Cap= 270.0 uF ESR= 8.0 mOhm VDC= 16.0 V IRMS= 5.8 A	1	$0.70	CAPSMT_62_C10 74 mm²
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 mm²
6.	D1	Diodes Inc.	MURS160-13-F	VF@Io= 1.25 V VRRM= 600.0 V	1	$0.11	SMB 44 mm²
7.	D2	Toshiba	CMS06	VF@Io= 320.0 mV VRRM= 30.0 V	1	$0.19	M-FLAT 19 mm²
8.	D3	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	$0.21	PowerDI123 13 mm²

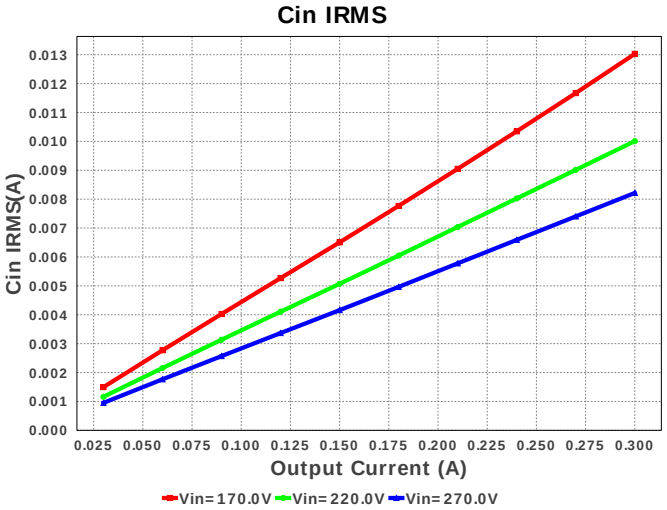
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	$0.24	 DF-S 99 mm²
10.	Dz	ON Semiconductor	1SMB5953BT3G	Zener	1	$0.10	 SMB 44 mm²
11.	L1	Bourns	PM2120-471K-RC	L= 470.0 µH DCR= 120.0 mOhm	1	$1.33	 PM2120 890 mm²
12.	M1	IXYS	IXTA06N120P	VdsMax= 1.2 kV IdsMax= 600.0 mAmps	1	$1.43	 DDPAK 210 mm²
13.	Rbld	Vishay-Dale	CRCW040224K3FKED Series= CRCW..e3	Res= 24.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
14.	Rcbc	Vishay-Dale	CRCW0402102KFKED Series= CRCW..e3	Res= 102.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
15.	Rcs	Vishay-Dale	CRCW040212R1FKED Series= CRCW..e3	Res= 12.1 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 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	CRCW040223K7FKED Series= CRCW..e3	Res= 23.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
18.	Rfbt	Vishay-Dale	CRCW0402124KFKED Series= CRCW..e3	Res= 124.0 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.	Rl	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
22.	Rlc	Vishay-Dale	CRCW04021K58FKED Series= CRCW..e3	Res= 1.58 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
23.	Rs	Vishay-Dale	CRCW04028K25FKED Series= CRCW..e3	Res= 8.25 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

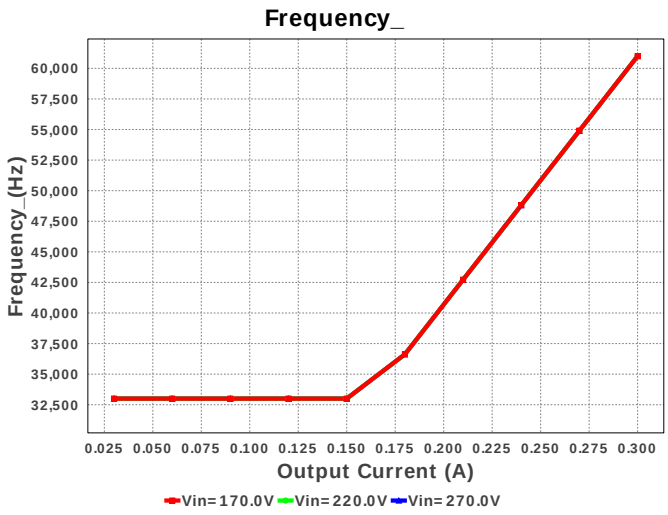
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
24.	T1	CUSTOM	CUSTOM	Lp= 19.968 mH Rp= 9.534 Ohm Leakage_L= 399.351 µH Ns1toNp= 0.039 Rs1= 105.321 mOhms Ns2toNp= 0.136 Rs2= 532.0 Ohms	1	NA	CUSTOM 0 mm^2
25.	U1	Texas Instruments	UCC28710DR	Switcher	1	$0.42	 SOIC-7 0 mm^2

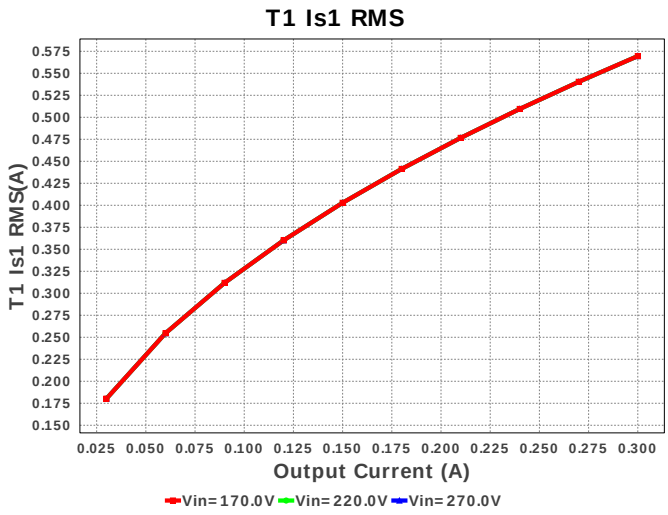


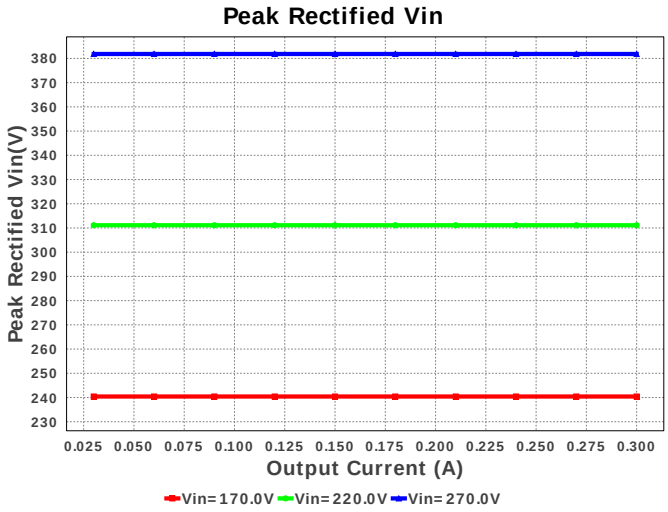


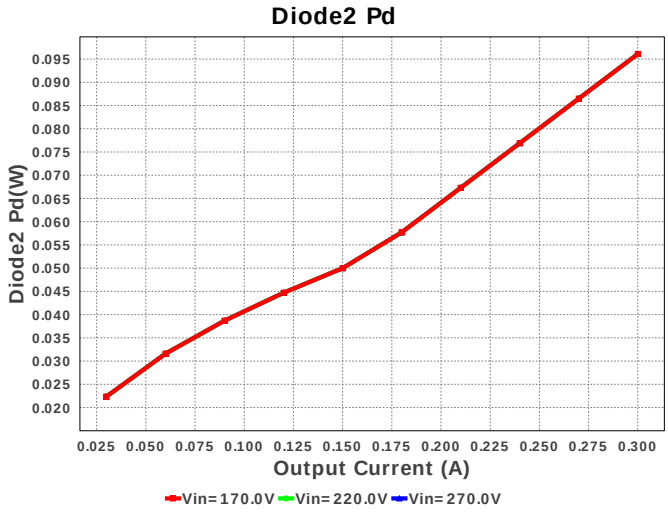


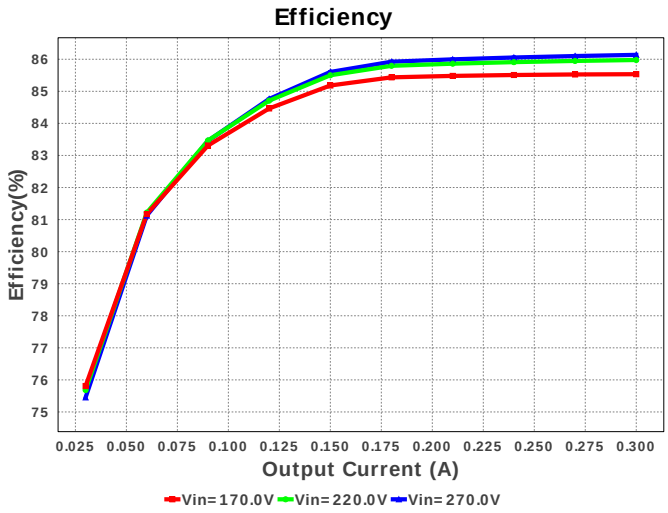


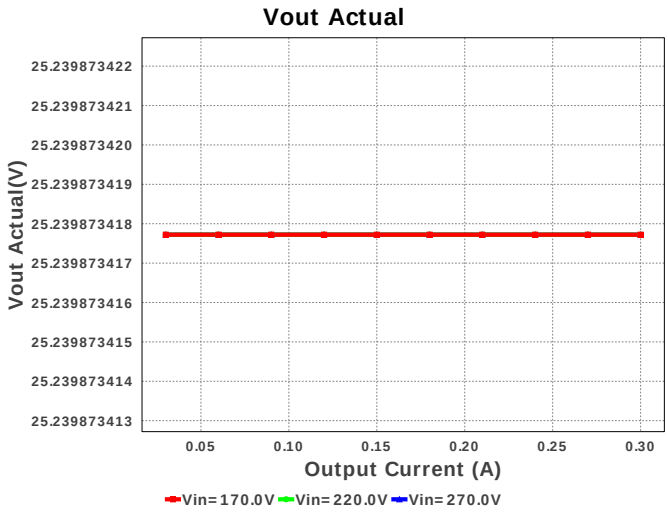


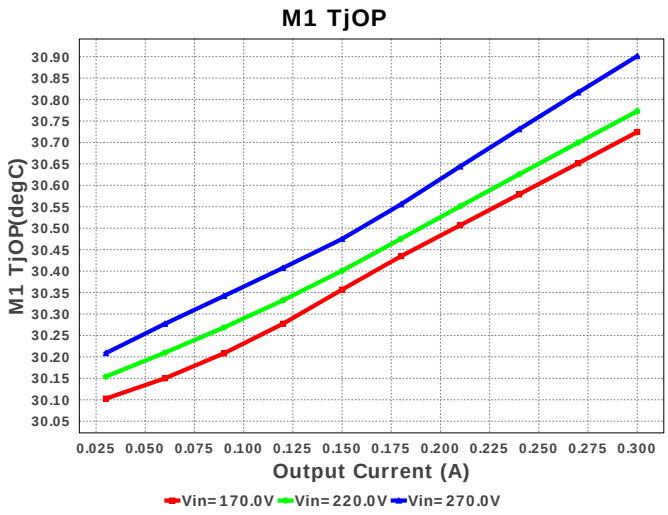


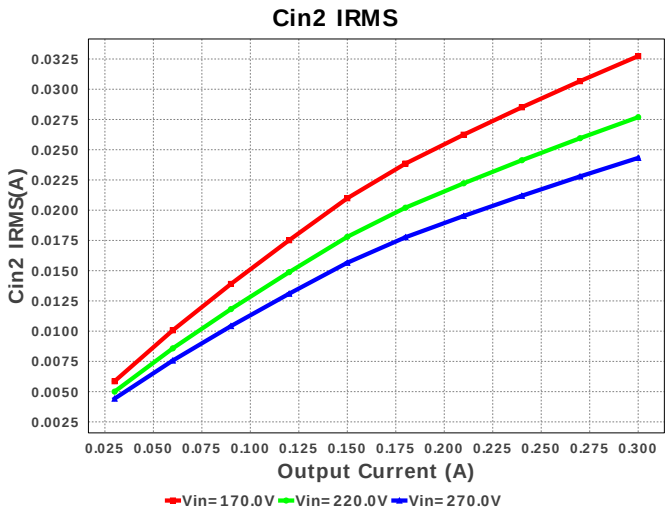


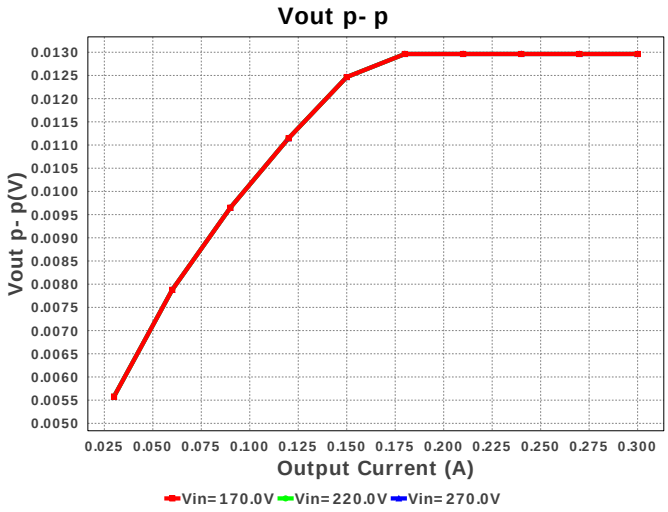


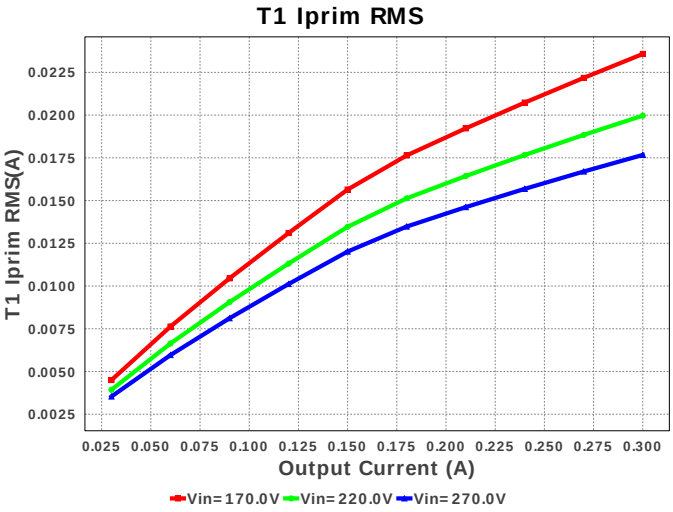


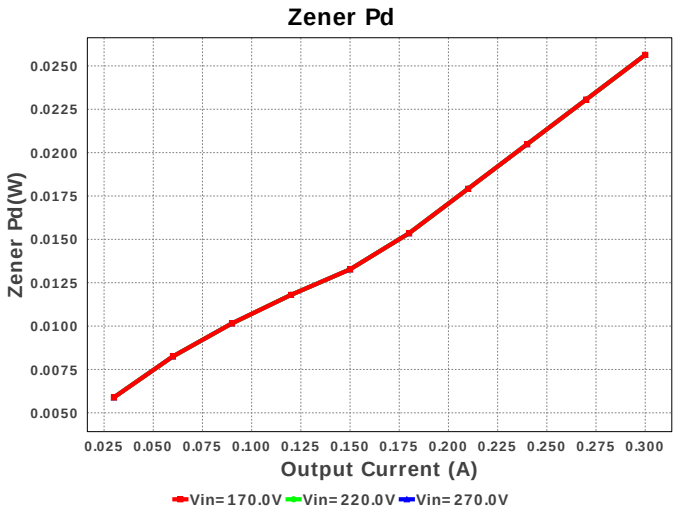


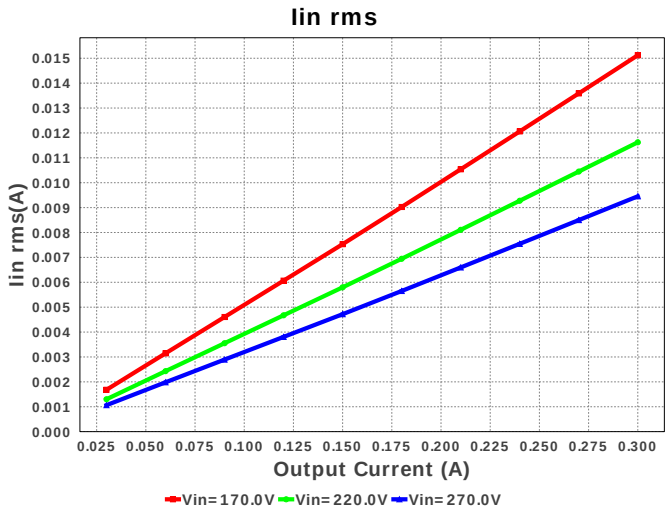


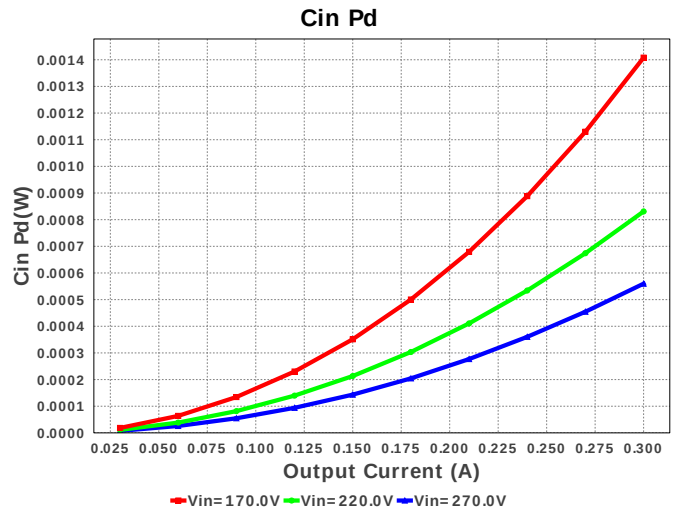


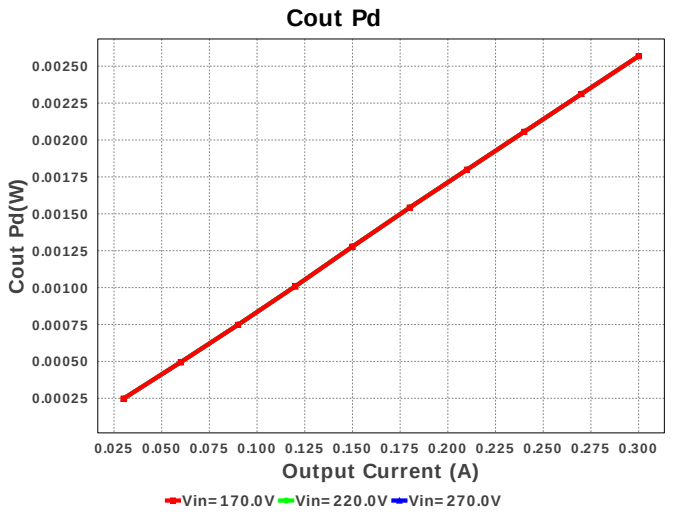


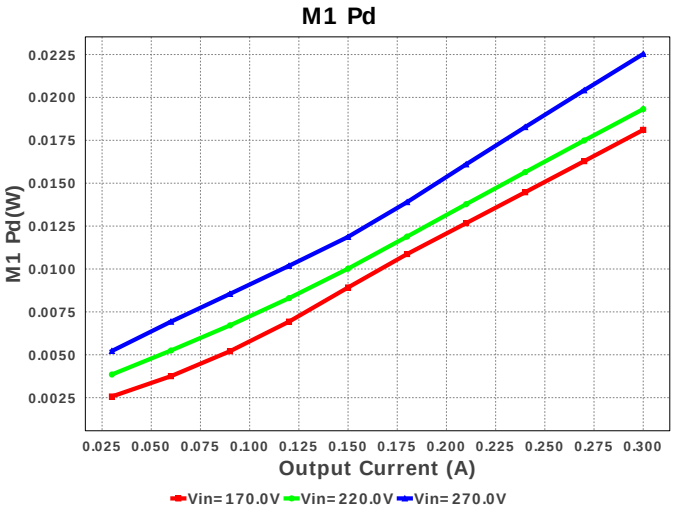


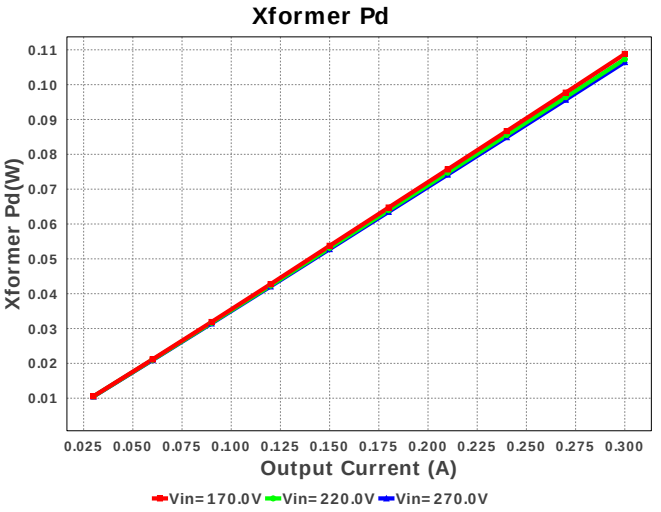


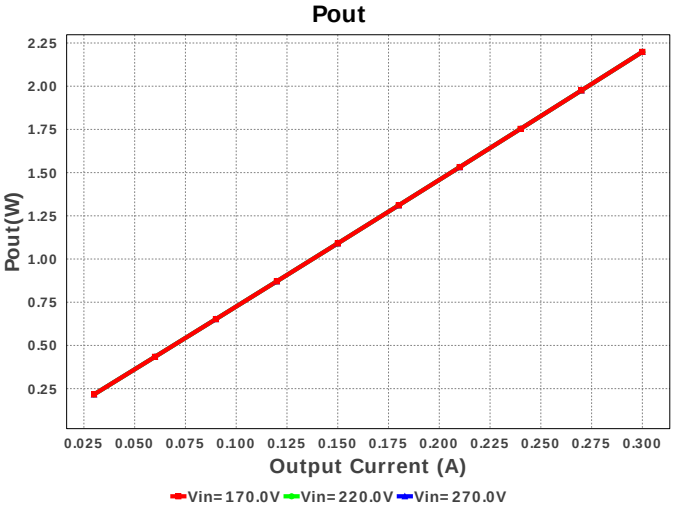


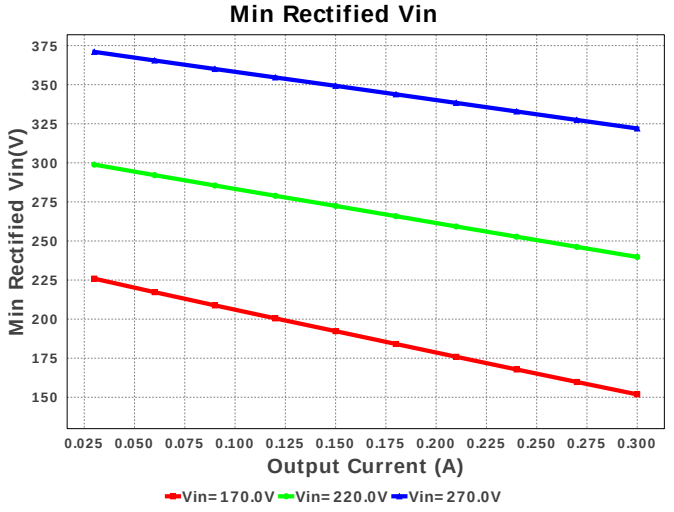


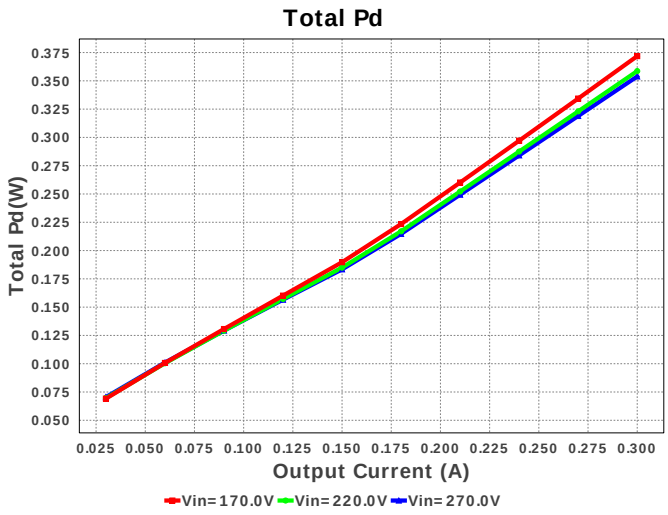


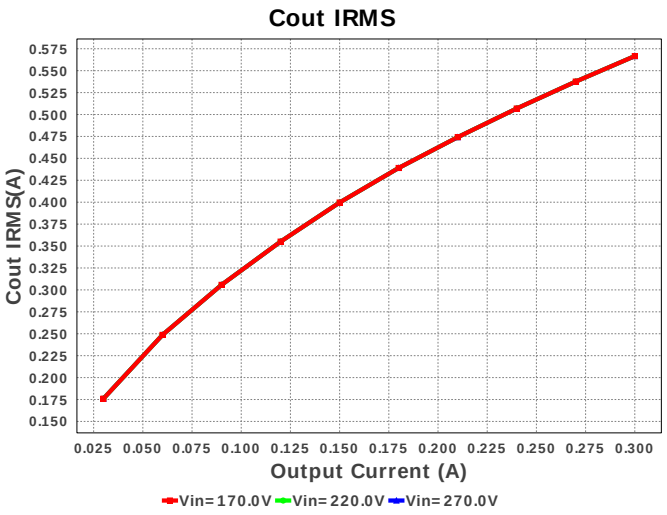


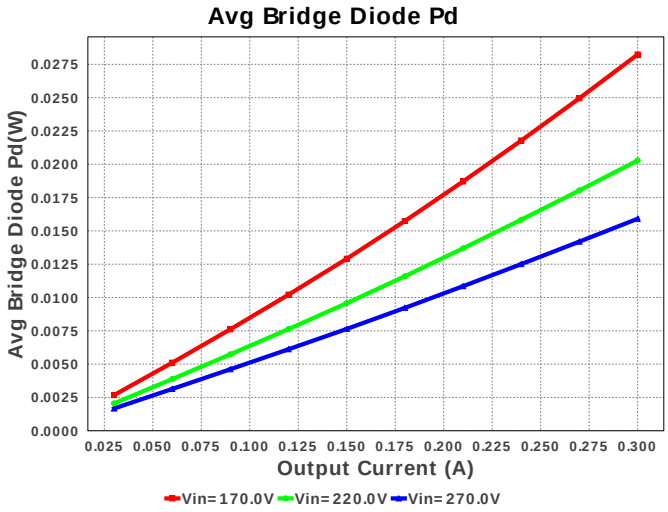


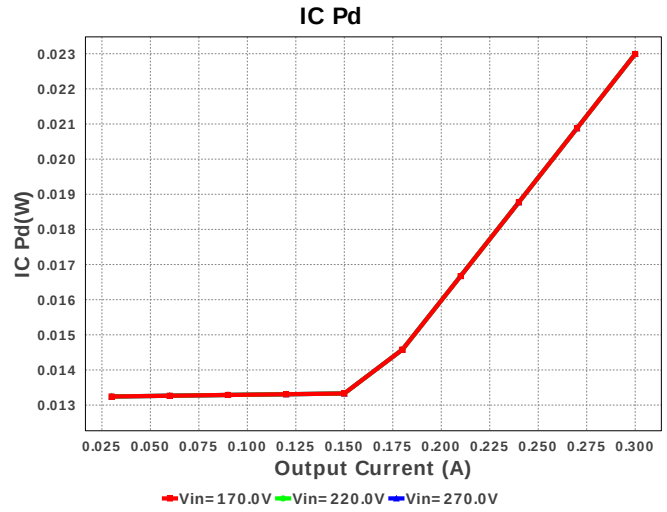


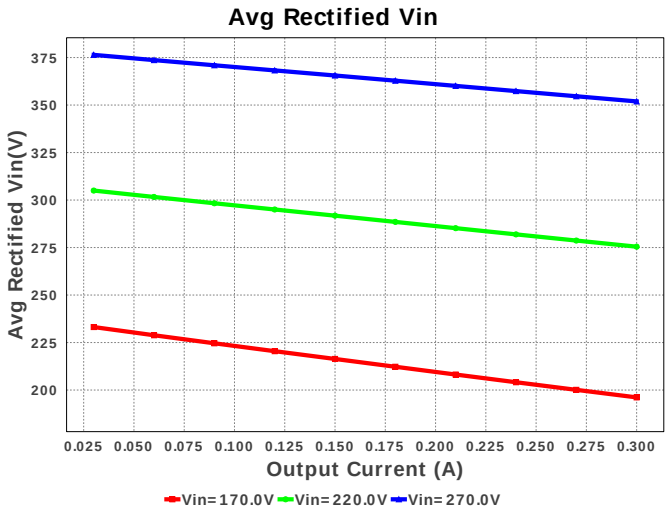


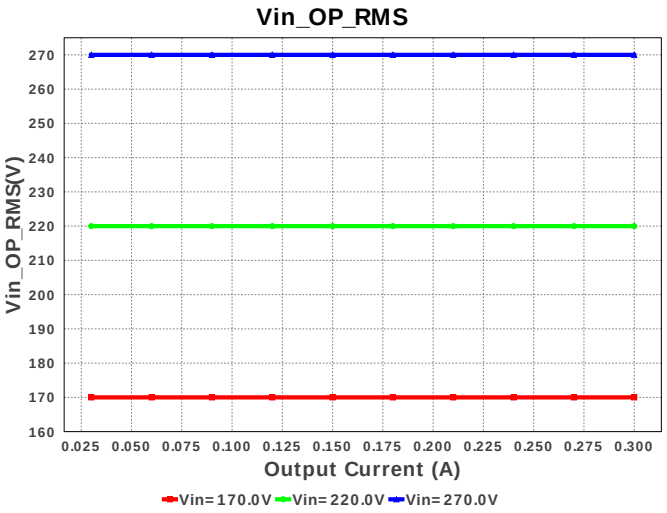


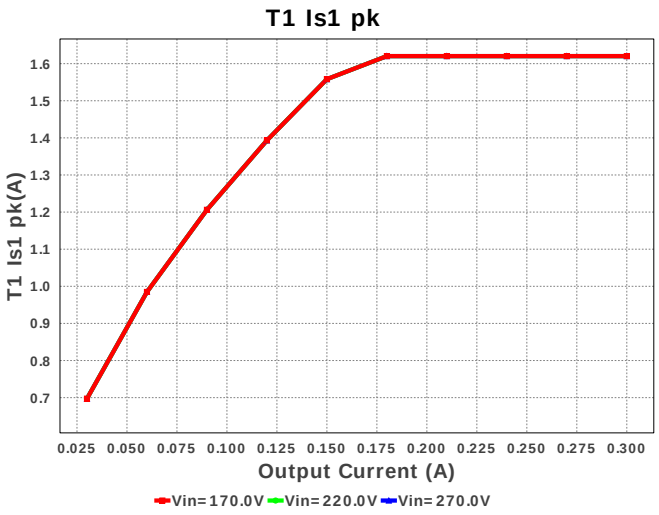


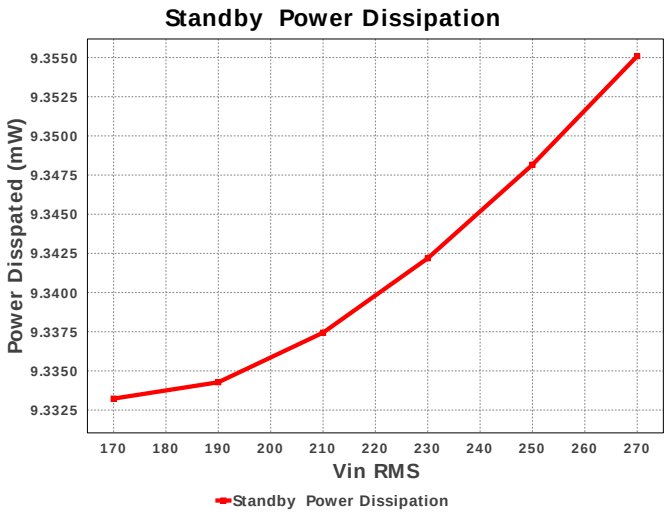


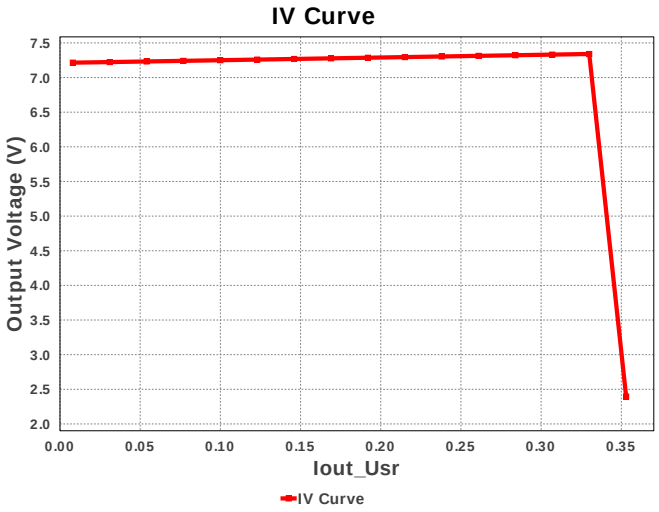












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	7.961 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	23.744 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	568.805 mA	Current	Output capacitor RMS ripple current
4.	Iin rms	9.102 mA	Current	RMS Input Current
5.	T1 Iprim RMS	17.227 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	64.463 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	571.749 mA	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	1.633 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	359.338 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	25	General	Total Design BOM count
11.	FootPrint	1.566 k mm^2	General	Total Foot Print Area of BOM components
12.	Mode	DCM	General	Conduction Mode
13.	Pout	2.198 W	General	Total output power
14.	Total BOM	$0.0	General	Total BOM Cost
15.	Vout Actual	25.24 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Vout OP	7.327 V	Op_Point	Operational Output Voltage
17.	Duty Cycle	21.426 %	Op_point	Duty cycle
18.	Efficiency	89.442 %	Op_point	Steady state efficiency
19.	Frequency	59.22 kHz	Op_point	Switching frequency
20.	IC Tj	31.566 degC	Op_point	IC junction temperature
21.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
22.	IOUT_OP	300.0 mA	Op_point	Iout operating point
23.	M1 TjOP	30.896 degC	Op_point	M1 MOSFET junction temperature
24.	Min Rectified Vin	336.842 V	Op_point	Minimum voltage seen at rectified input
25.	Peak Rectified Vin	381.834 V	Op_point	Peak voltage seen at rectified input
26.	Vin_OP_RMS	270.0 V	Op_point	AC Input RMS Voltage
27.	Vout p-p	13.063 mV	Op_point	Peak-to-peak output ripple voltage
28.	Avg Bridge Diode Pd	8.05 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
29.	Cin Pd	525.786 µW	Power	Input capacitor power dissipation
30.	Cout Pd	2.588 mW	Power	Output capacitor power dissipation
31.	Diode2 Pd	63.517 mW	Power	Diode2 power dissipation

#	Name	Value	Category	Description
32.	IC Pd	22.378 mW	Power	IC power dissipation
33.	M1 Pd	22.409 mW	Power	M1 MOSFET total power dissipation
34.	Total Pd	259.47 mW	Power	Total Power Dissipation
35.	Xformer Pd	105.585 mW	Power	Transformer power dissipation
36.	Zener Pd	6.804 mW	Power	Zener power dissipation
37.	Vout Tolerance	2.7 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	300.0 m	Maximum Output Current
2.	VinMax	270.0	Maximum input voltage
3.	VinMin	170.0	Minimum input voltage
4.	Vout	7.0	Output Voltage
5.	line_fsw	60.0	Light Output in Lumen
6.	base_pn	UCC28710	Base Product 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 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.