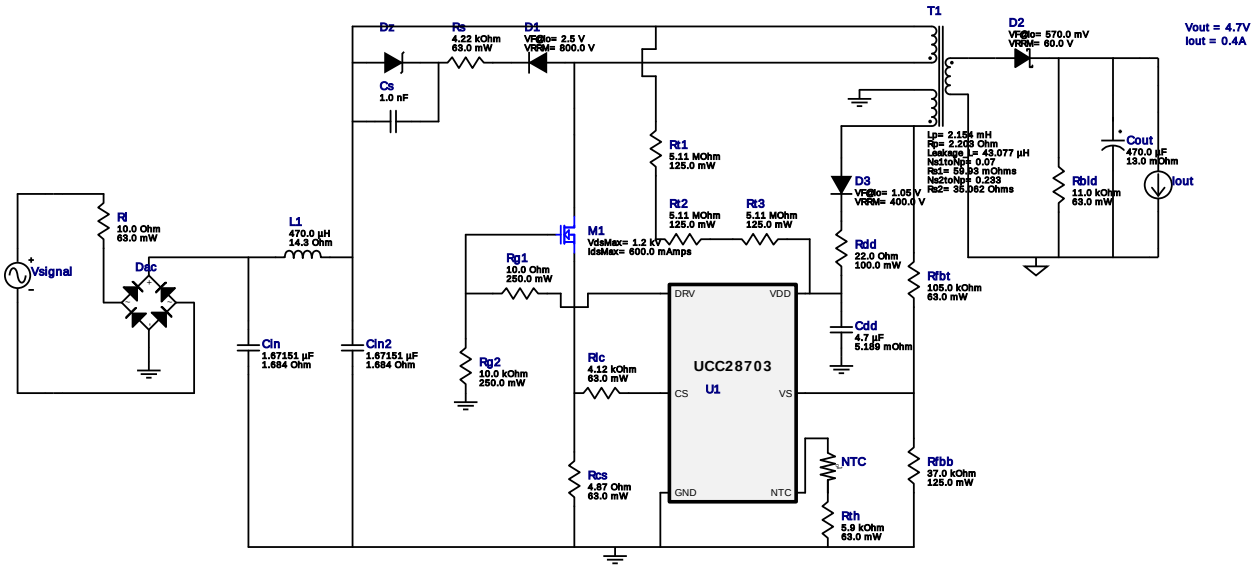
VinMin = 85.0V
VinMax = 265.0V
Vout = 4.7V
Iout = 0.4A

Device = UCC28703DBVR
Topology = Flyback
Created = 8/30/16 9:51:30 AM
BOM Cost = $0.00
BOM Count = 29
Total Pd = 0.43W

WEBENCH® Design Report

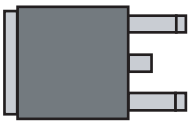
Design : 4009018/146 UCC28703DBVR
UCC28703DBVR 85.0V-265.0V to 4.70V @ 0.4A



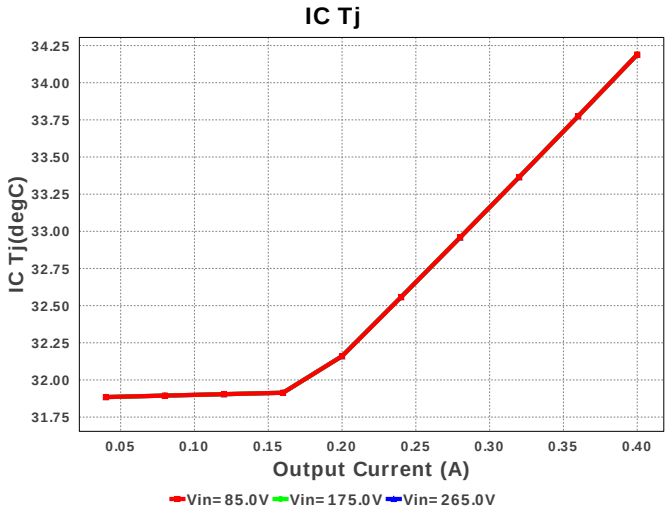
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

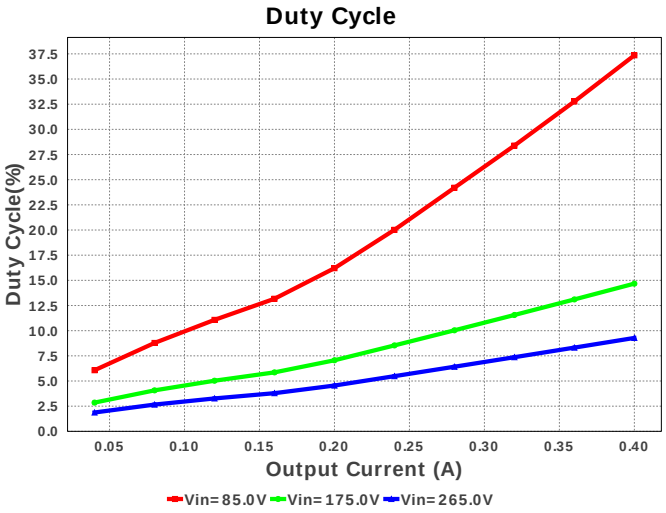
Electrical BOM

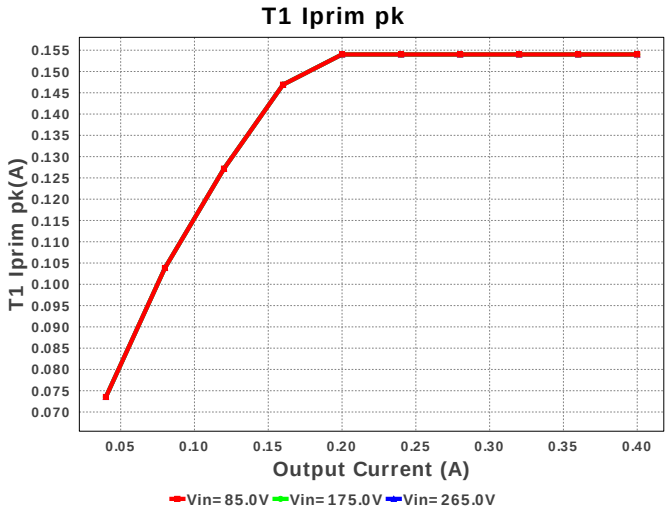
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 5.189 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	$0.02	0805 7 mm²
2.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 1.67151 uF ESR= 1.684 Ohm VDC= 562.14 V IRMS= 103.1 mA	1	NA	CUSTOM 0 mm²
3.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 1.67151 uF ESR= 1.684 Ohm VDC= 562.14 V IRMS= 103.1 mA	1	NA	CUSTOM 0 mm²
4.	Cout	Chemi-Con	APXE6R3ARA471MH80G Series= PXE	Cap= 470.0 uF ESR= 13.0 mOhm VDC= 6.3 V IRMS= 3.95 A	1	$0.69	CAPSMT_62_H80 106 mm²
5.	Cs	MuRata	GRM155R72A102KA01D Series= X7R	Cap= 1.0 nF VDC= 100.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
6.	D1	Bourns	CD1408-FU1800	VF@Io= 2.5 V VRRM= 800.0 V	1	$0.13	Diode_1408 13 mm²
7.	D2	NXP Semiconductor	PMEG6010CEH,115	VF@Io= 570.0 mV VRRM= 60.0 V	1	$0.04	SOD-123F 12 mm²
8.	D3	Bourns	CD1408-FU1400	VF@Io= 1.05 V VRRM= 400.0 V	1	$0.13	Diode_1408 13 mm²
9.	Dac	unknown		unknown		NA	

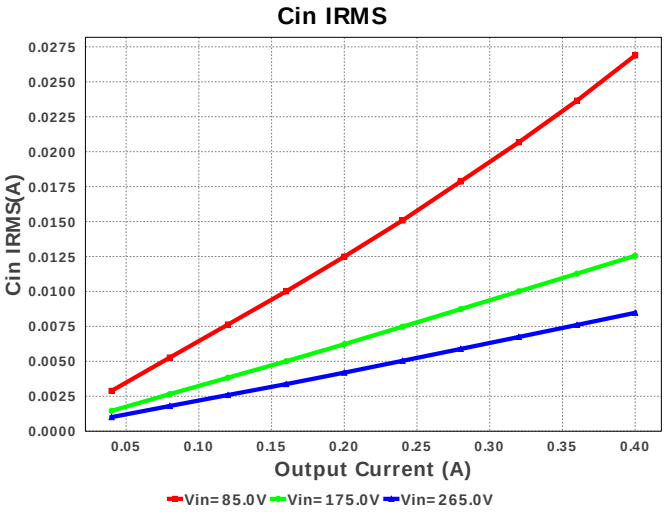
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Dz	ON Semiconductor	BZX84C75LT1G	Zener	1	$0.02	 SOT-23 14 mm²
11.	L1	Bourns	SDR0302-471KL	L= 470.0 µH DCR= 14.3 Ohm	1	$0.18	 SDR0302 15 mm²
12.	M1	IXYS	IXTA06N120P	VdsMax= 1.2 kV IdsMax= 600.0 mAmps	1	$1.43	 DDPAK 210 mm²
13.	Rbld	Vishay-Dale	CRCW040211K0FKED Series= CRCW..e3	Res= 11.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
14.	Rcs	Vishay-Dale	CRCW04024R87FKED Series= CRCW..e3	Res= 4.87 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
15.	Rdd	Yageo America	RC0603FR-0722RL Series= ?	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
16.	Rfbb	Yageo America	RT0805BRD0737KL Series= RT0805	Res= 37.0 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	0805 7 mm²
17.	Rfbt	Vishay-Dale	CRCW0402105KFKED Series= CRCW..e3	Res= 105.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
18.	Rg1	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm²
19.	Rg2	Panasonic	ERJ-8ENF1002V Series= ERJ-8E	Res= 10.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm²
20.	Rl	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
21.	Rlc	Vishay-Dale	CRCW04024K12FKED Series= CRCW..e3	Res= 4.12 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
22.	Rs	Vishay-Dale	CRCW04024K22FKED Series= CRCW..e3	Res= 4.22 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
23.	Rt1	Vishay-Dale	CRCW08055M11FKEA Series= CRCW..e3	Res= 5.11 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
24.	Rt2	Vishay-Dale	CRCW08055M11FKEA Series= CRCW..e3	Res= 5.11 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
25.	Rt3	Vishay-Dale	CRCW08055M11FKEA Series= CRCW..e3	Res= 5.11 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
26.	Rth	Vishay-Dale	CRCW04025K90FKED Series= CRCW..e3	Res= 5.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
27.	T1	CUSTOM	CUSTOM	Lp= 2.154 mH Rp= 2.203 Ohm Leakage_L= 43.077 µH Ns1toNp= 0.07 Rs1= 59.93 mOhms Ns2toNp= 0.233 Rs2= 35.062 Ohms	1	NA	CUSTOM 0 mm²

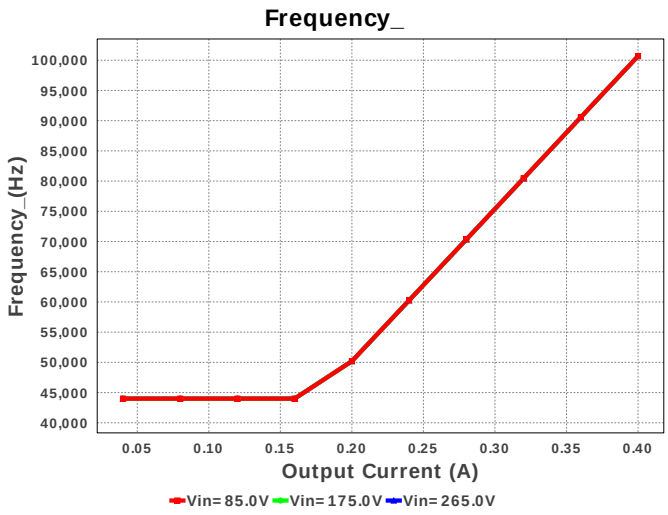
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	U1	Texas Instruments	UCC28703DBVR	Switcher	1	$0.35	SOT-23-6 15 mm²

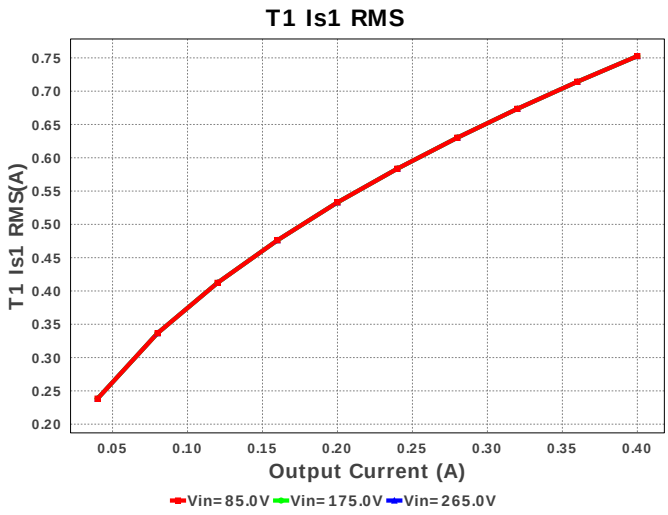


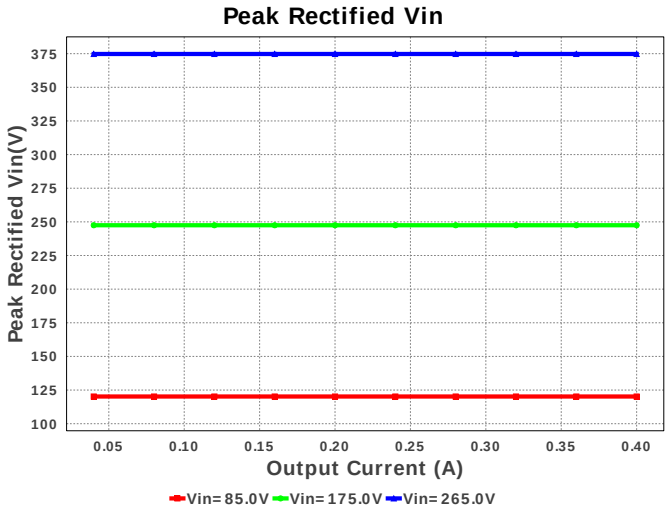


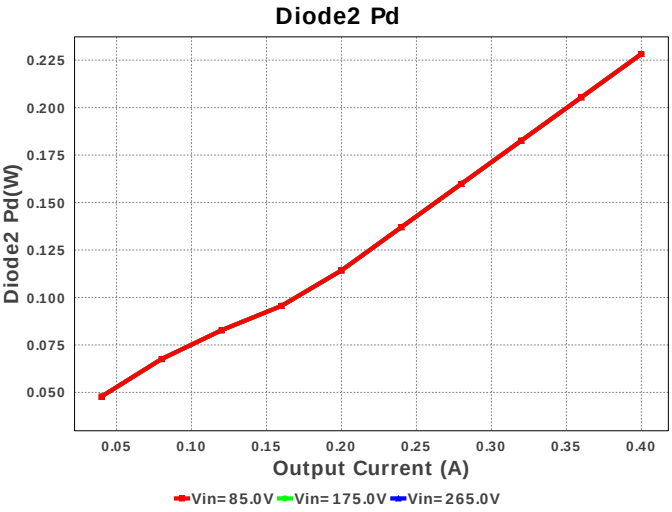


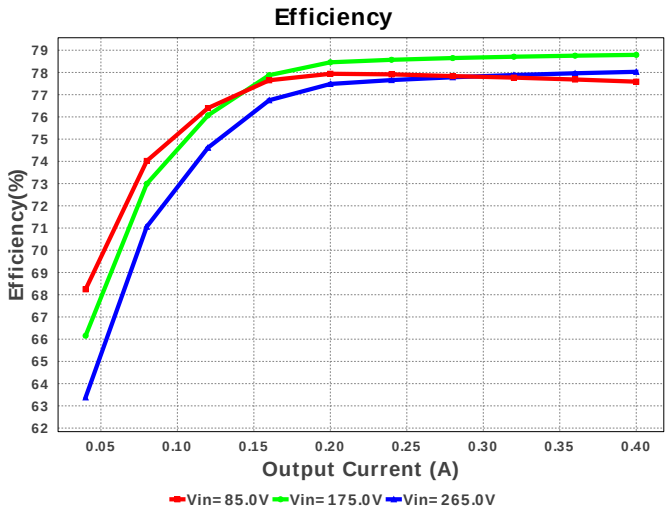


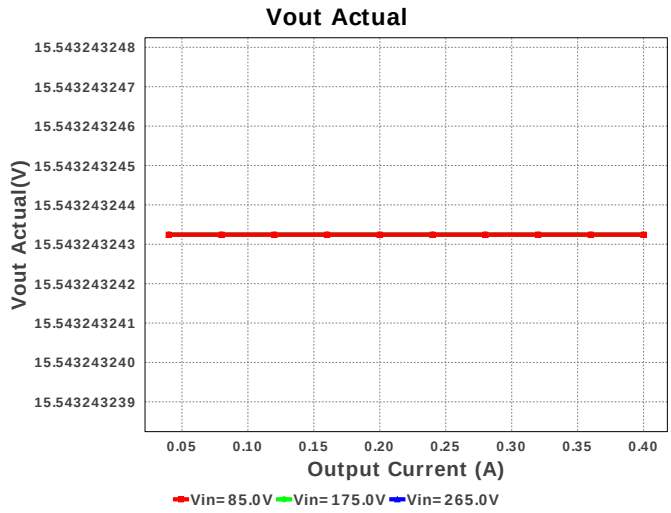


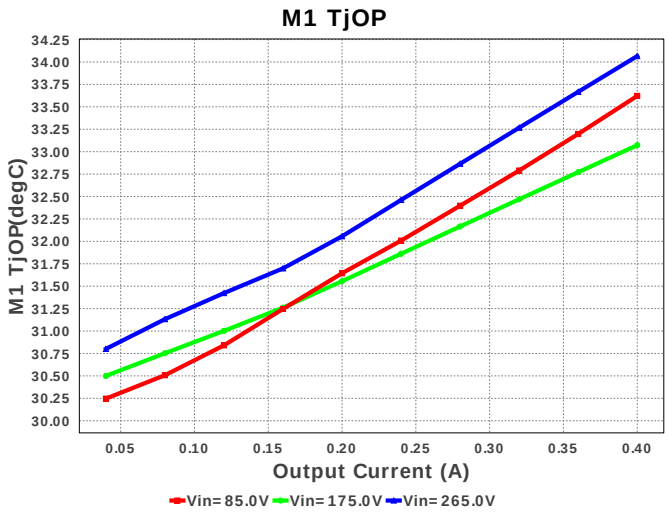


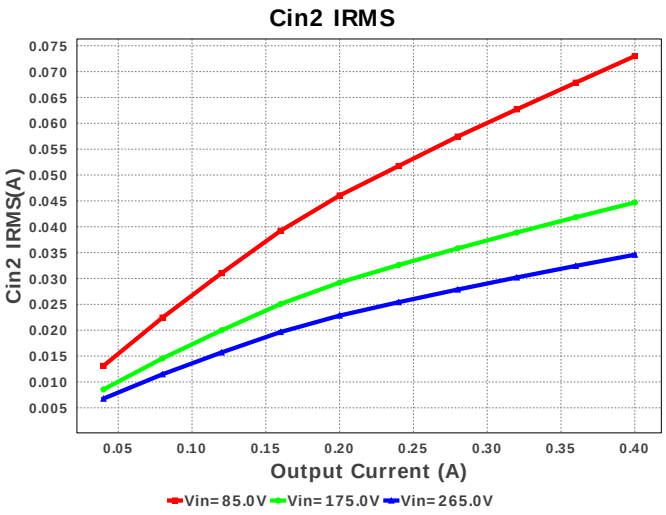


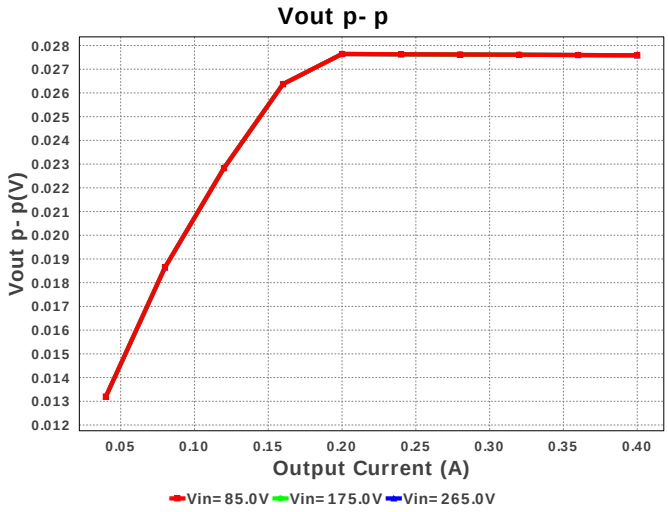


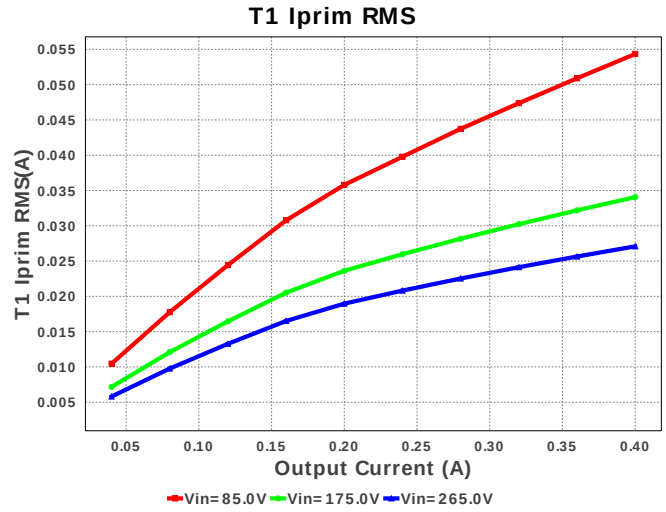


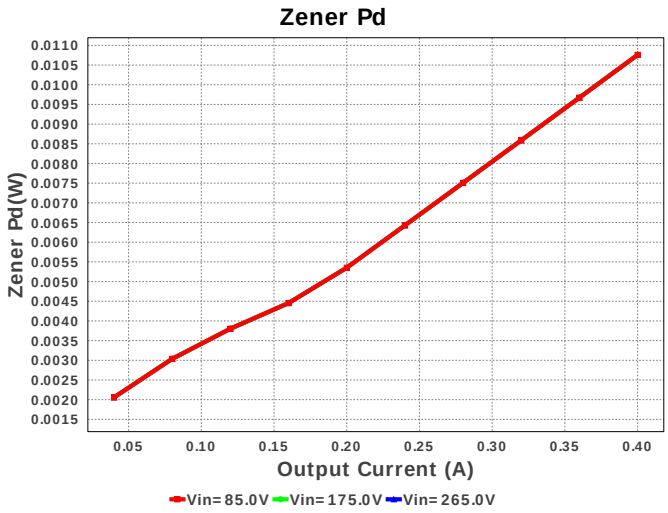


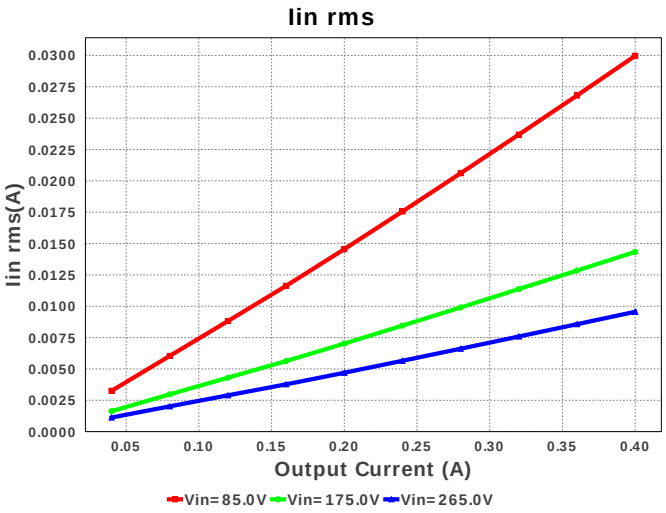




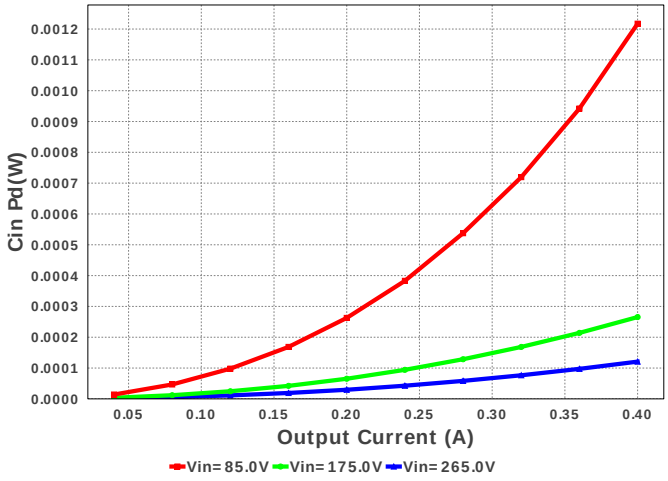




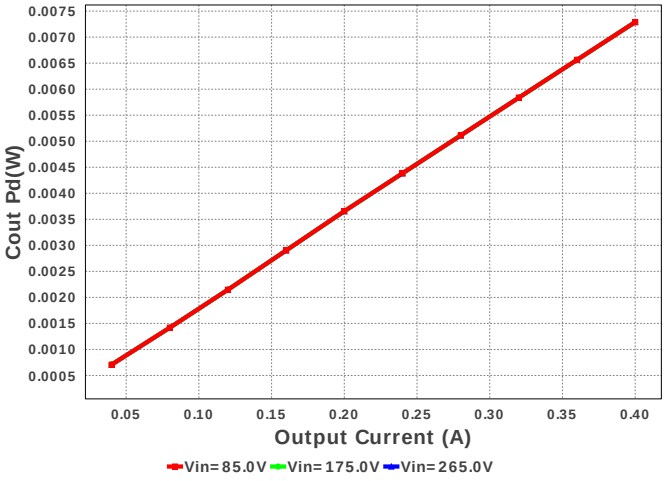




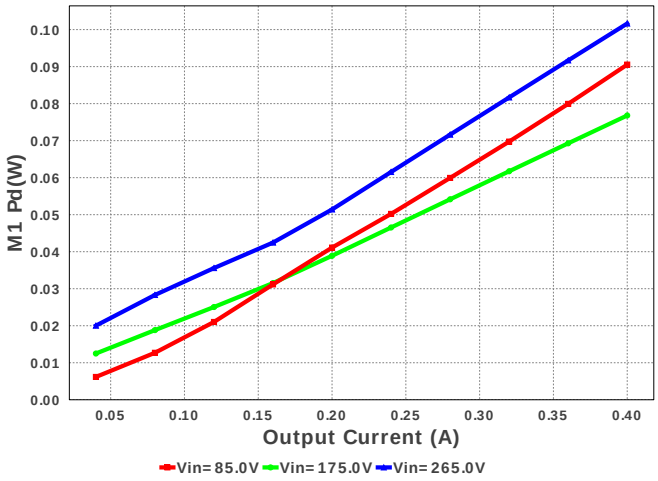
Cin Pd



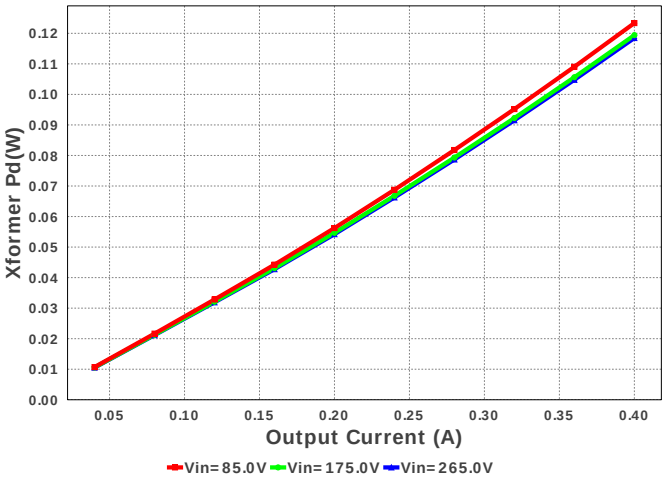
Cout Pd



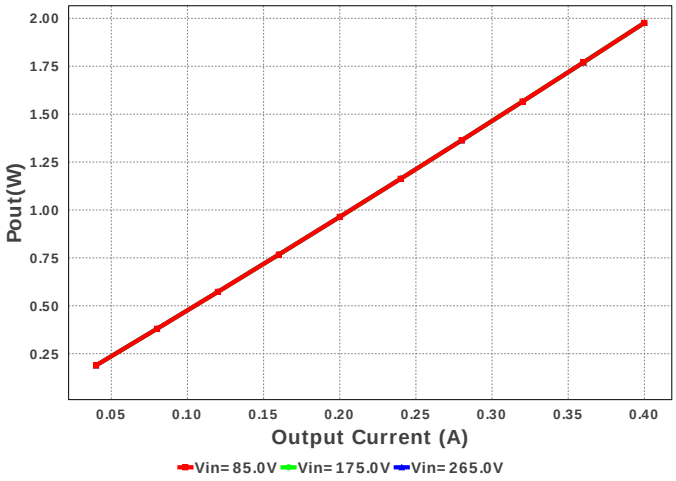
M1 Pd



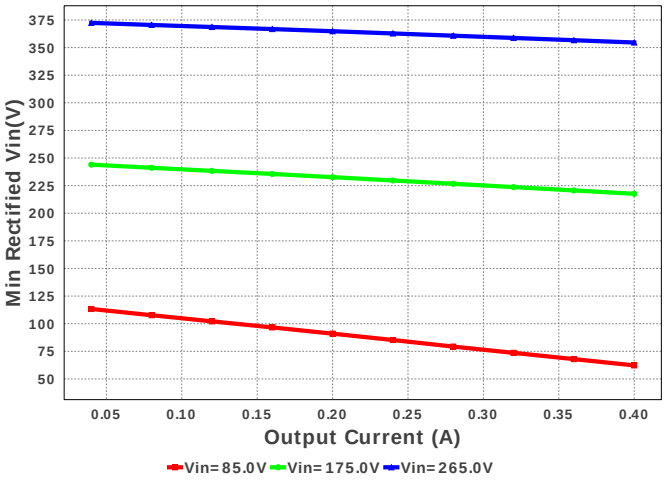
Xformer Pd

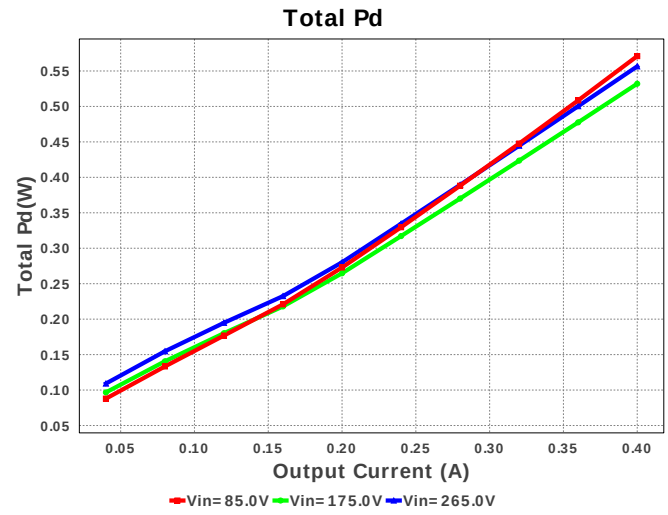


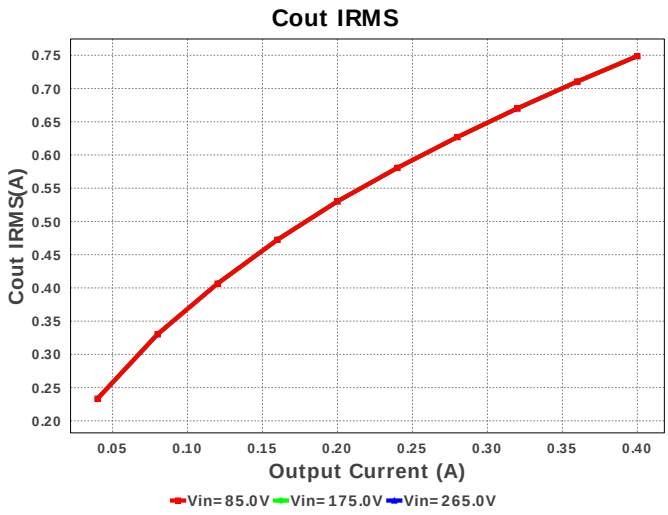
Pout

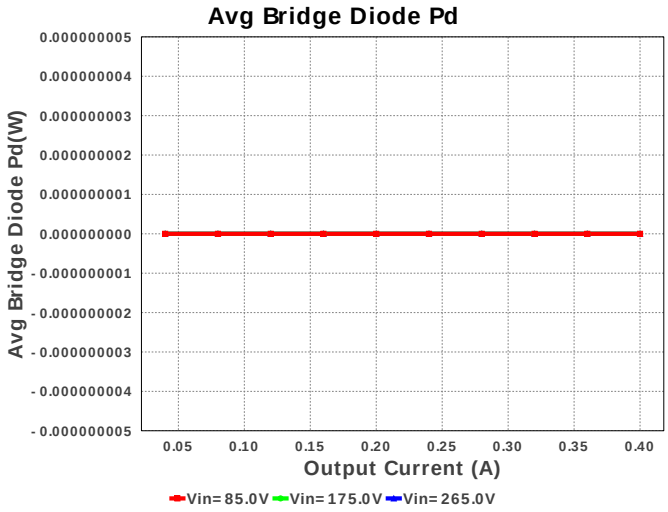


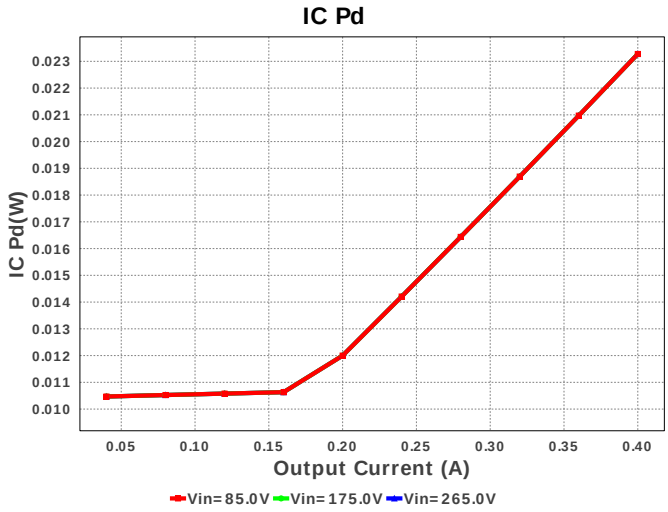
Min Rectified Vin

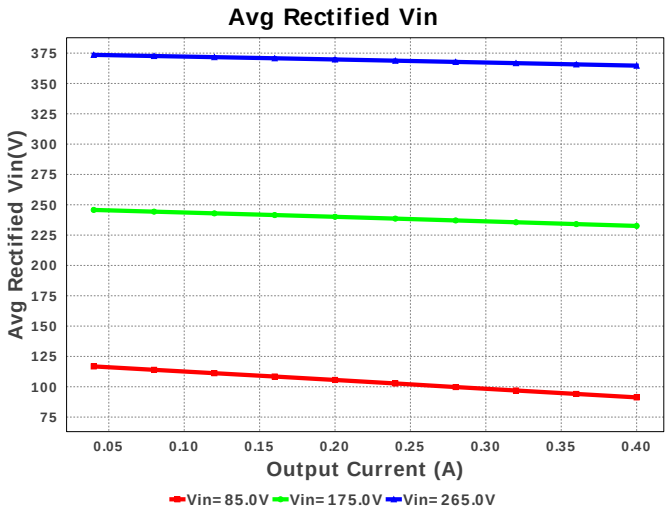


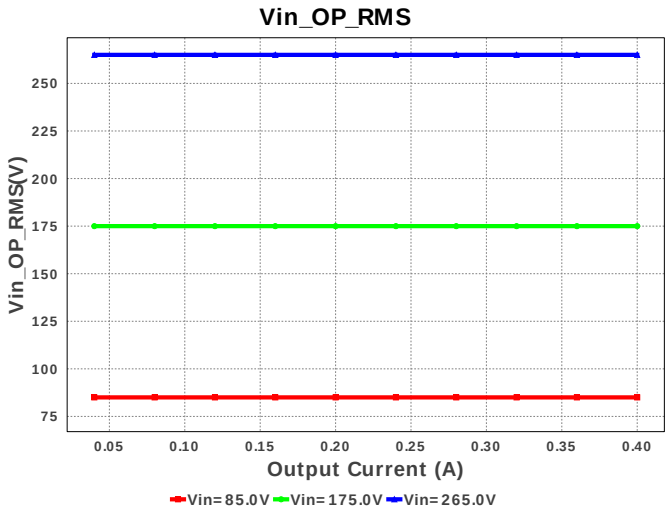


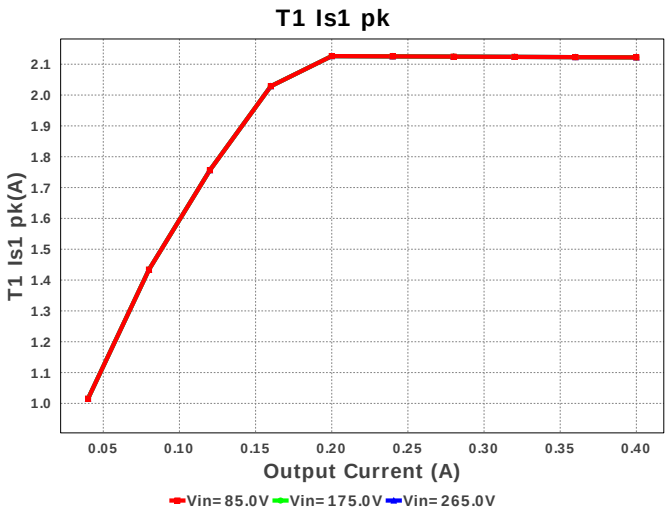


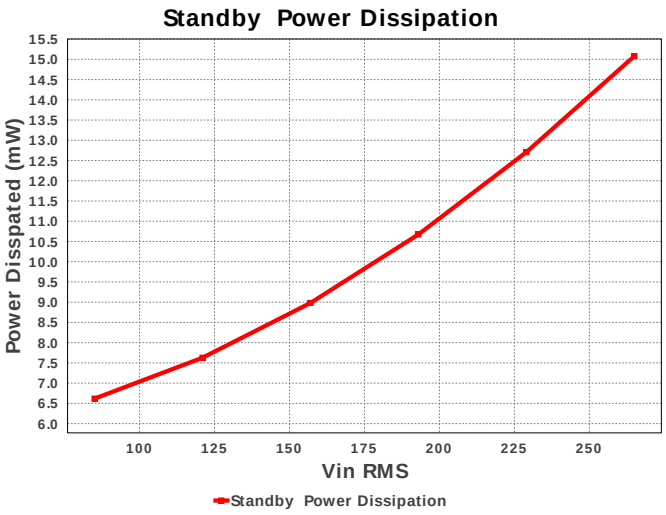


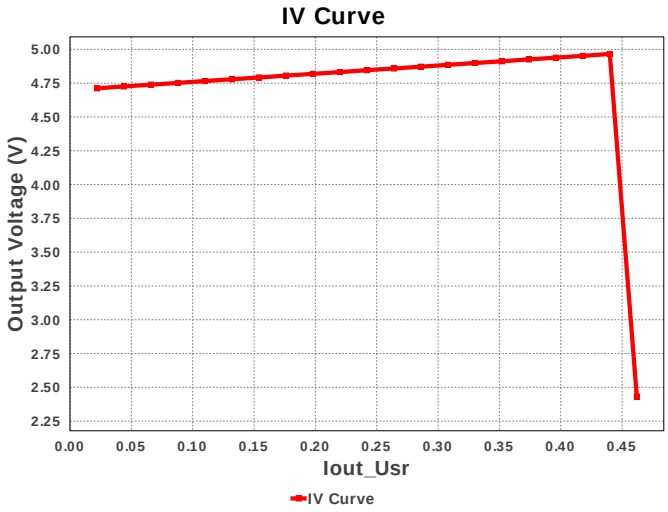












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	8.091 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	33.521 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	751.967 mA	Current	Output capacitor RMS ripple current
4.	Iin rms	9.098 mA	Current	RMS Input Current
5.	T1 Iprim RMS	26.309 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	154.004 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	755.869 mA	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	2.14 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	366.962 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	29	General	Total Design BOM count
11.	FootPrint	557.0 mm^2	General	Total Foot Print Area of BOM components
12.	Mode	DCM	General	Conduction Mode
13.	Pout	1.976 W	General	Total output power
14.	Total BOM	$0.0	General	Total BOM Cost
15.	Vout Actual	15.543 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Vout OP	4.941 V	Op_Point	Operational Output Voltage
17.	Duty Cycle	8.755 %	Op_point	Duty cycle
18.	Efficiency	81.979 %	Op_point	Steady state efficiency
19.	Frequency	95.703 kHz	Op_point	Switching frequency
20.	IC Tj	31.553 degC	Op_point	IC junction temperature
21.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
22.	IOUT_OP	400.0 mA	Op_point	Iout operating point
23.	M1 TjOP	33.911 degC	Op_point	M1 MOSFET junction temperature
24.	Min Rectified Vin	359.162 V	Op_point	Minimum voltage seen at rectified input
25.	Peak Rectified Vin	374.763 V	Op_point	Peak voltage seen at rectified input
26.	Vin_OP_RMS	265.0 V	Op_point	AC Input RMS Voltage
27.	Vout p-p	27.823 mV	Op_point	Peak-to-peak output ripple voltage
28.	Avg Bridge Diode Pd	0.0 W	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
29.	Cin Pd	110.23 µW	Power	Input capacitor power dissipation
30.	Cout Pd	7.351 mW	Power	Output capacitor power dissipation
31.	Diode2 Pd	156.982 mW	Power	Diode2 power dissipation

#	Name	Value	Category	Description
32.	IC Pd	22.192 mW	Power	IC power dissipation
33.	M1 Pd	97.787 mW	Power	M1 MOSFET total power dissipation
34.	Total Pd	434.462 mW	Power	Total Power Dissipation
35.	Xformer Pd	115.181 mW	Power	Transformer power dissipation
36.	Zener Pd	2.801 mW	Power	Zener power dissipation
37.	Vout Tolerance	1.013 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	400.0 m	Maximum Output Current
2.	VinMax	265.0	Maximum input voltage
3.	VinMin	85.0	Minimum input voltage
4.	Vout	4.7	Output Voltage
5.	line_fsw	60.0	Light Output in Lumen
6.	base_pn	UCC28703	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 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.