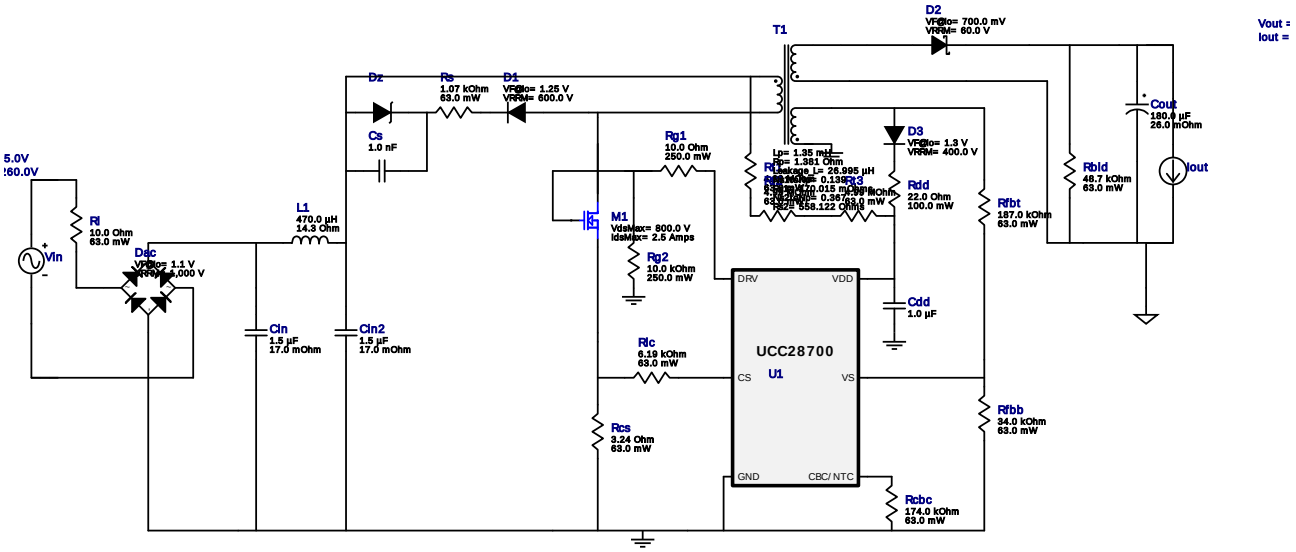
WEBENCH® Design Report

VinMin = 85.0V
VinMax = 260.0V
Vout = 10.0V
Iout = 0.3A

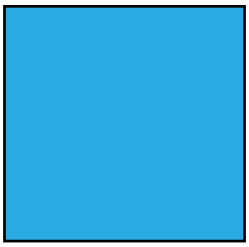
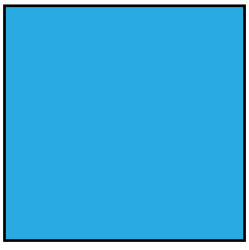
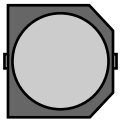
Device = UCC28700DBVR
Topology = Flyback
Created = 5/3/13 5:14:42 PM
BOM Cost = $0.00
Total Pd = 0.97W
Footprint = 775.0mm2
BOM Count = 30

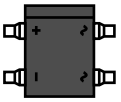
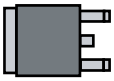
Design : 3509713/1 UCC28700DBVR
UCC28700DBVR 85.0V-260.0V to 10.094V @ 0.3A



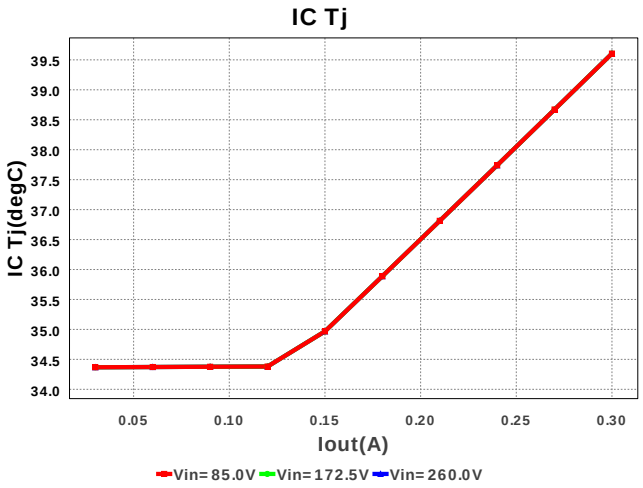
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

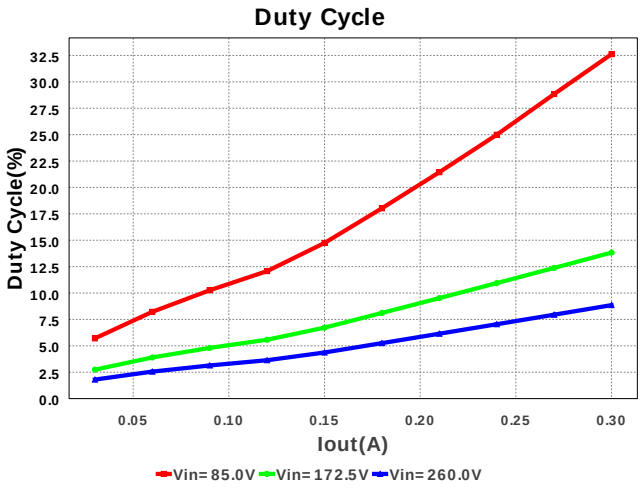
Electrical BOM

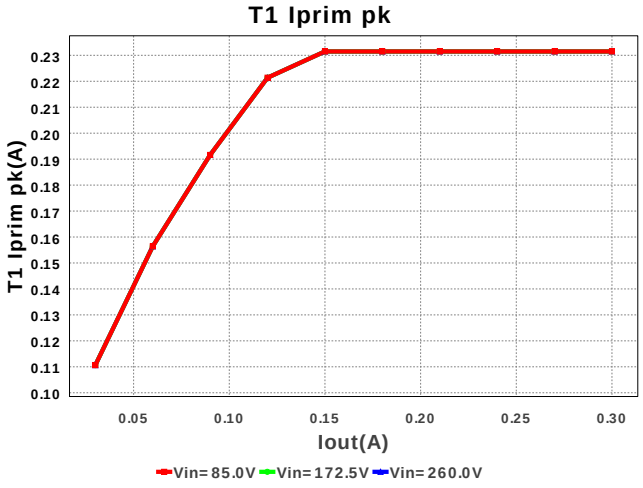
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 µF VDC= 35.0 V IRMS= 0.0 A	1	$0.05	 0805 13mm2
2.	Cin	EPCOS Inc	B32923C3155M Series= 302	Cap= 1.5 µF ESR= 17.0 mOhm VDC= 630.0 V IRMS= 146.0 mA	2	$0.71	 B32923_22mm 0mm2
3.	Cin2	EPCOS Inc	B32923C3155M Series= 302	Cap= 1.5 µF ESR= 17.0 mOhm VDC= 630.0 V IRMS= 146.0 mA	2	$0.71	 B32923_22mm 0mm2
4.	Cout	Nippon Chemi-Con	APXA160ARA181MJ80G Series= PXA	Cap= 180.0 µF ESR= 26.0 mOhm VDC= 16.0 V IRMS= 3.43 A	1	$1.07	 CAPSMT_62_J80 156mm2
5.	Cs	MuRata	GRM188R72E102KW07D Series= X7R	Cap= 1.0 nF VDC= 250.0 V IRMS= 0.0 A	1	$0.02	 0603 10mm2

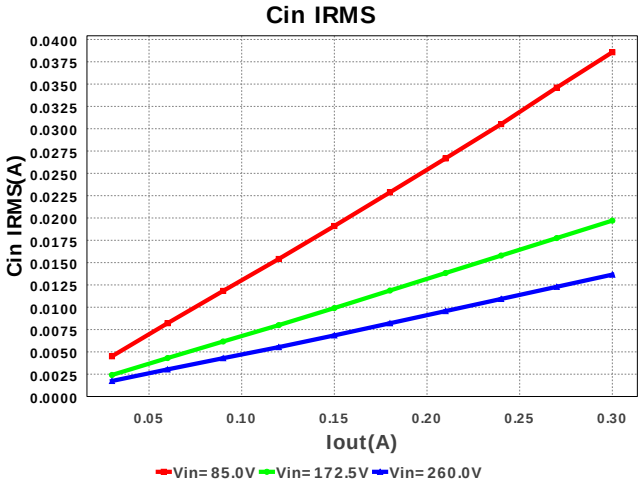
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	D1	Diodes Inc.	MURS160-13-F	VF@Io= 1.25 V VRRM= 600.0 V	1	$0.11	 SMB 44mm2
7.	D2	Diodes Inc.	B160-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.06	 SMA 37mm2
8.	D3	Diodes Inc.	RS1G-13-F	VF@Io= 1.3 V VRRM= 400.0 V	1	$0.07	 SMA 37mm2
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000 V	1	$0.14	 DF-S 99mm2
10.	Dz	ON Semiconductor	MMBZ5270BLT1G	Zener	1	$0.03	 SOT-23 22mm2
11.	L1	Bourns	SDR0302-471KL	L= 470.0 µH DCR= 14.3 Ohm	1	$0.17	 SDR0302 24mm2
12.	M1	ST Microelectronics	STD3NK80ZT4	VdsMax= 800.0 V IdsMax= 2.5 Amps	1	$0.62	 DPAK 102mm2
13.	Rbld	Vishay-Dale	CRCW040248K7FKED Series= CRCW..e3	Res= 48.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
14.	Rcbc	Vishay-Dale	CRCW0402174KFKED Series= CRCW..e3	Res= 174.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
15.	Rcs	Vishay-Dale	CRCW04023R24FKED Series= CRCW..e3	Res= 3.24 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
16.	Rdd	Susumu Co Ltd	RR1220Q-220-D Series= 264	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 0.5%	1	$0.01	 0805 13mm2
17.	Rfbb	Vishay-Dale	CRCW040234K0FKED Series= CRCW..e3	Res= 34.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
18.	Rfbt	Vishay-Dale	CRCW0402187KFKED Series= CRCW..e3	Res= 187.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
19.	Rg1	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 19mm2
20.	Rg2	Panasonic	ERJ-8ENF1002V Series= ERJ-8E	Res= 10.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 19mm2
21.	Rl	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
22.	Rlc	Vishay-Dale	CRCW04026K19FKED Series= CRCW..e3	Res= 6.19 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
23.	Rs	Vishay-Dale	CRCW04021K07FKED Series= CRCW..e3	Res= 1.07 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
24.	Rt1	Vishay-Dale	CRCW04024M99FKED Series= CRCW..e3	Res= 4.99 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
25.	Rt2	Vishay-Dale	CRCW04024M99FKED Series= CRCW..e3	Res= 4.99 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2

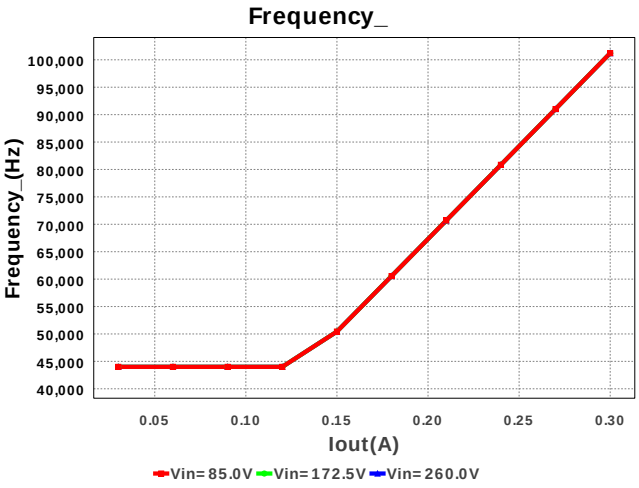
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	Rt3	Vishay-Dale	CRCW04024M99FKED Series= CRCW..e3	Res= 4.99 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 8mm2
27.	T1	CUSTOM	CUSTOM	Lp= 1.35 mH Rp= 1.381 Ohm Leakage_L= 26.995 µH Ns1toNp= 0.139 Rs1= 170.015 mOhms Ns2toNp= 0.367 Rs2= 558.122 Ohms	1	NA	CUSTOM 0mm2
28.	U1	Texas Instruments	UCC28700DBVR	Switcher	1	$0.35	SOT-23-6 24mm2

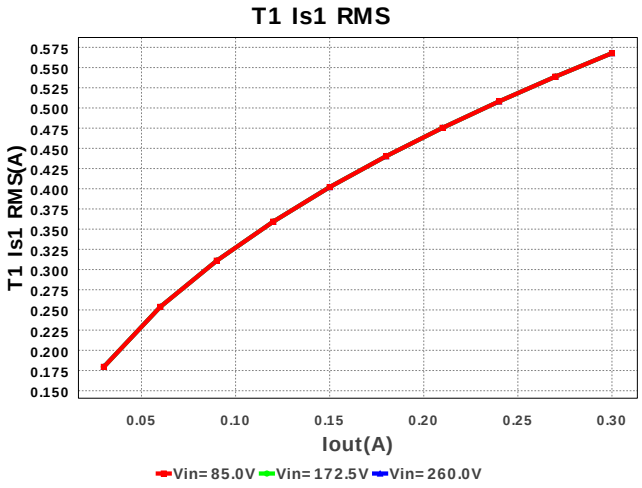


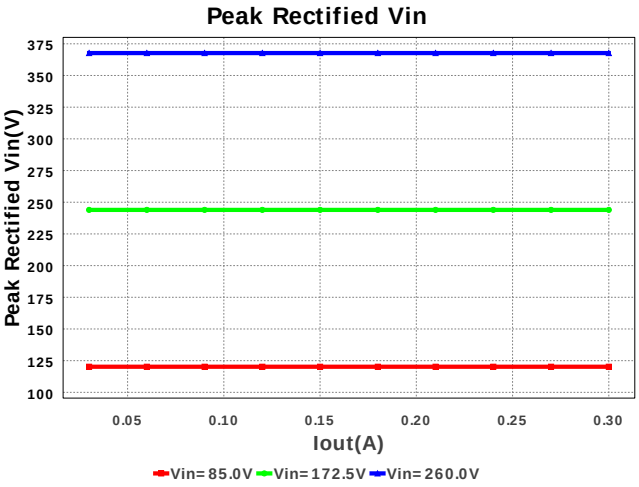


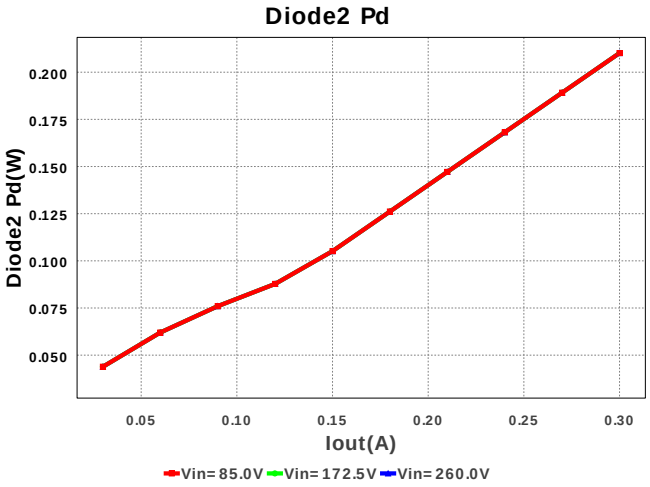


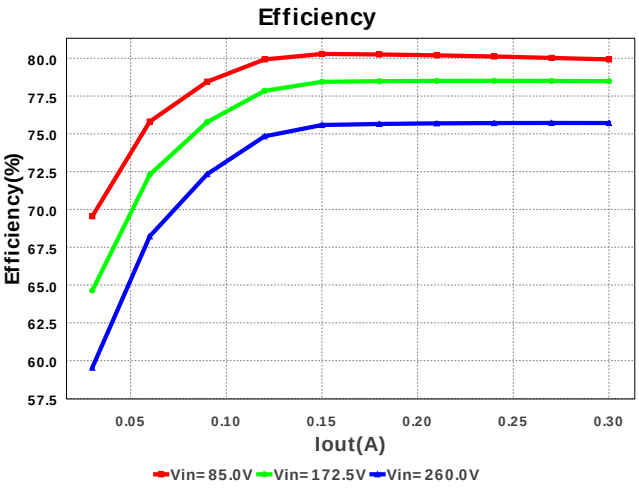


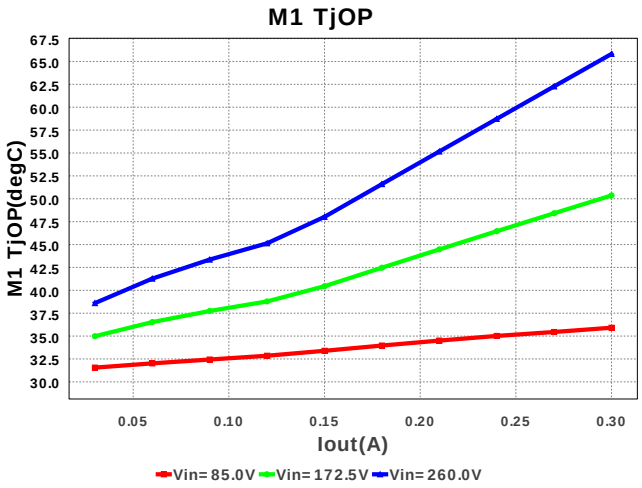




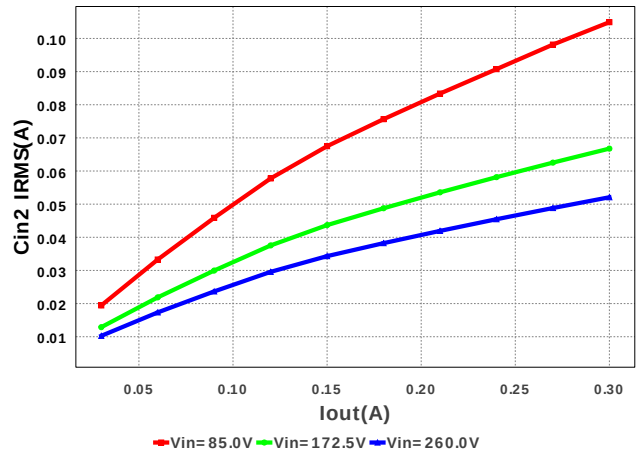




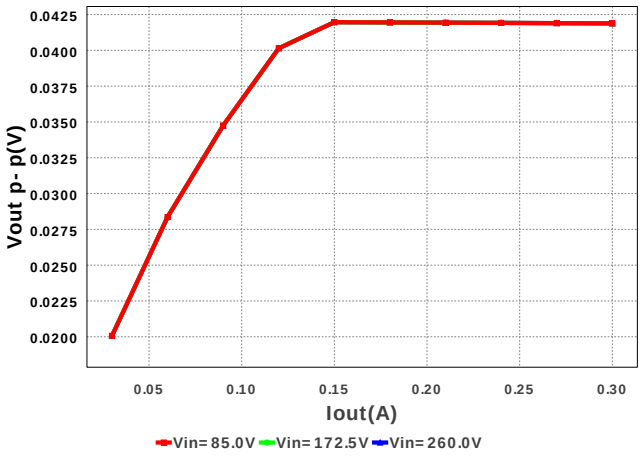




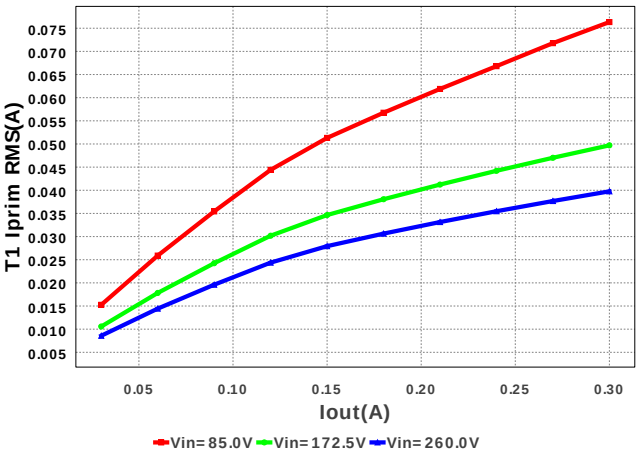
Cin2 IRMS



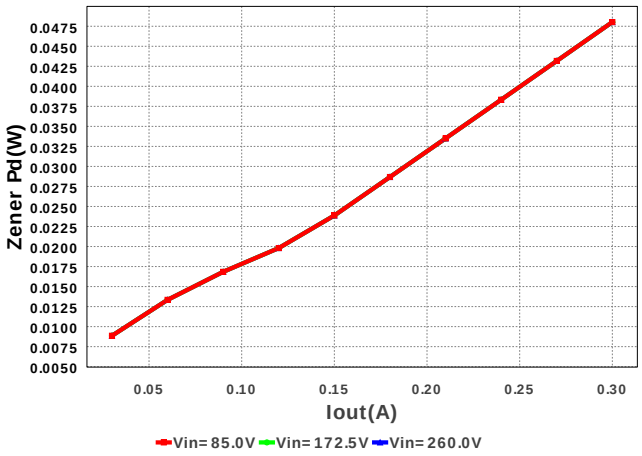
Vout p- p



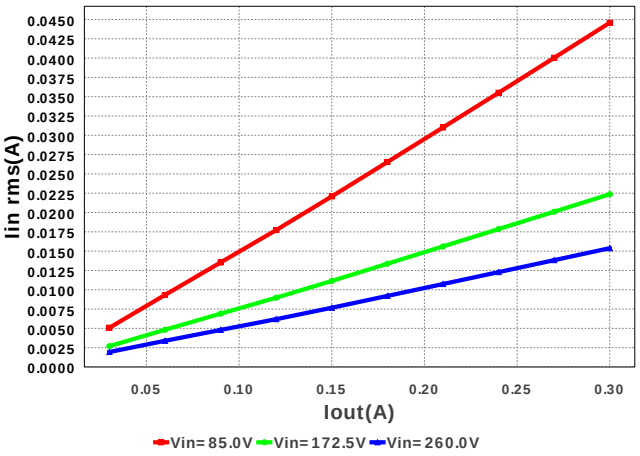
T1 Iprim RMS



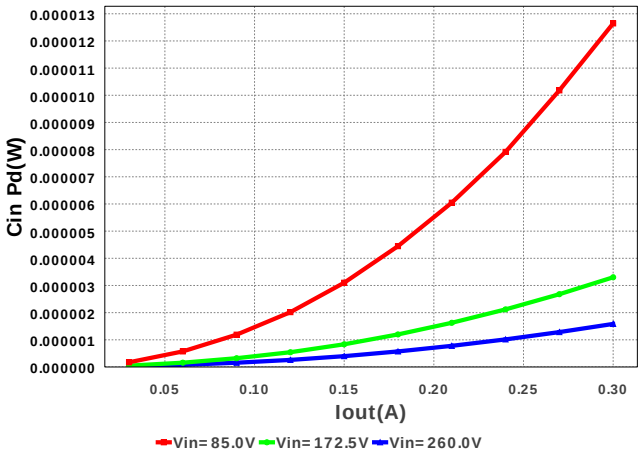
Zener Pd

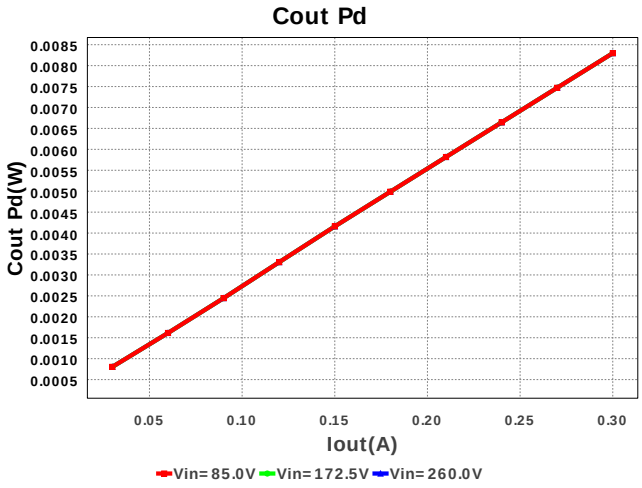


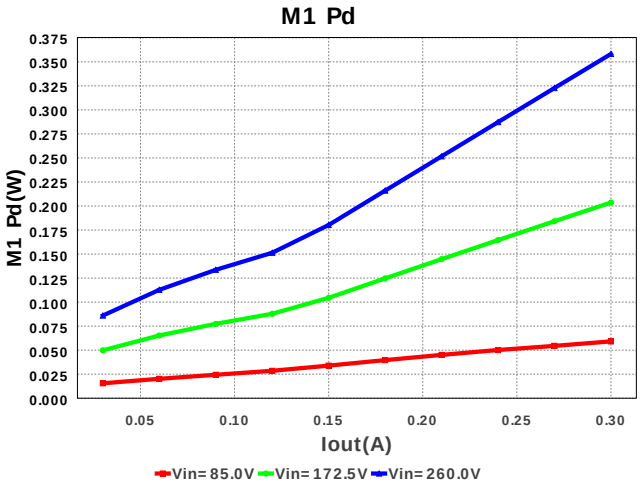
Iin rms

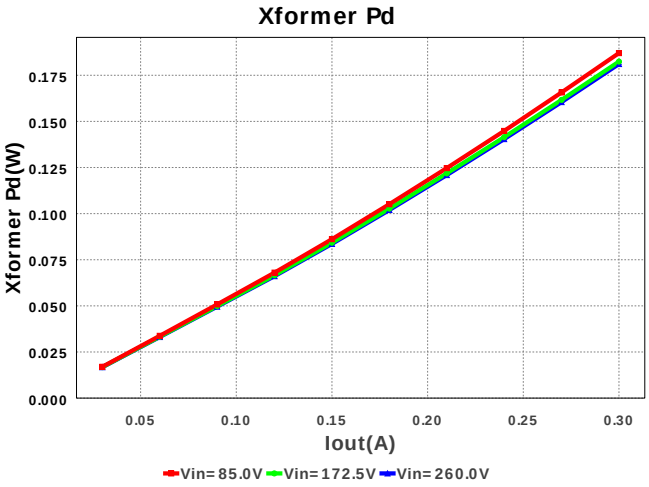


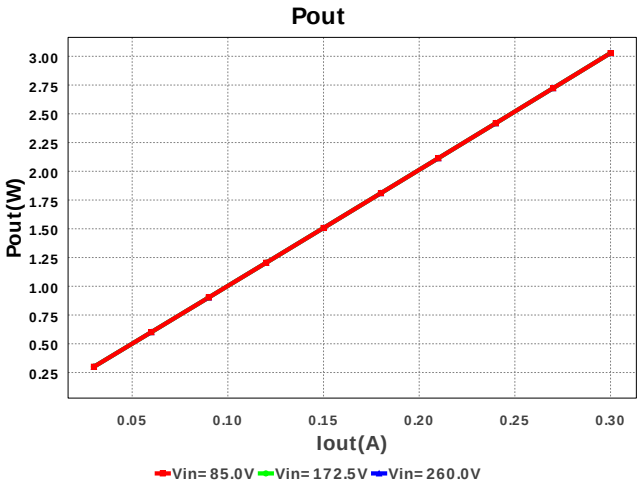
Cin Pd

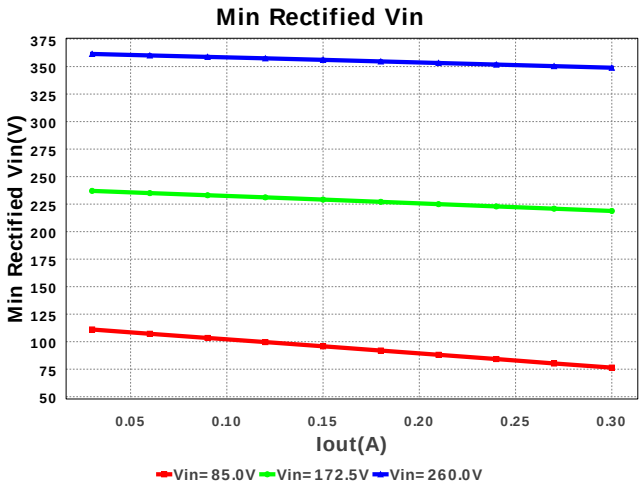


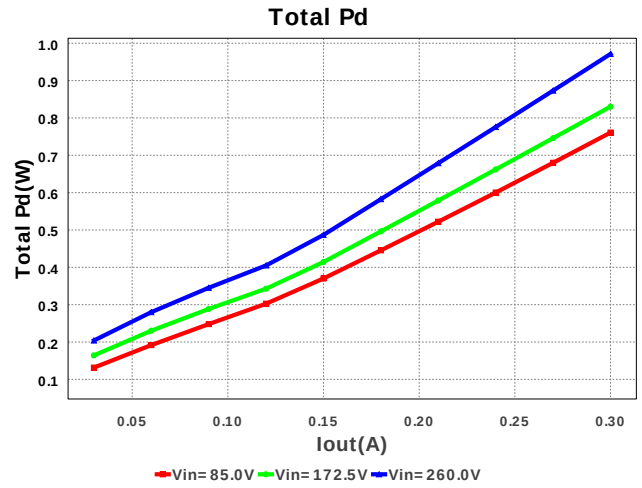




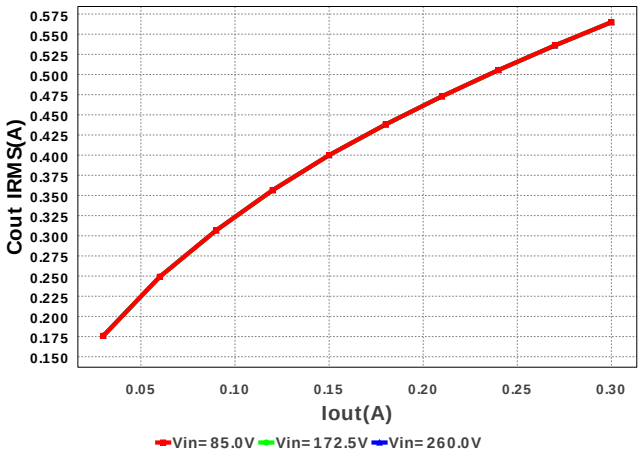




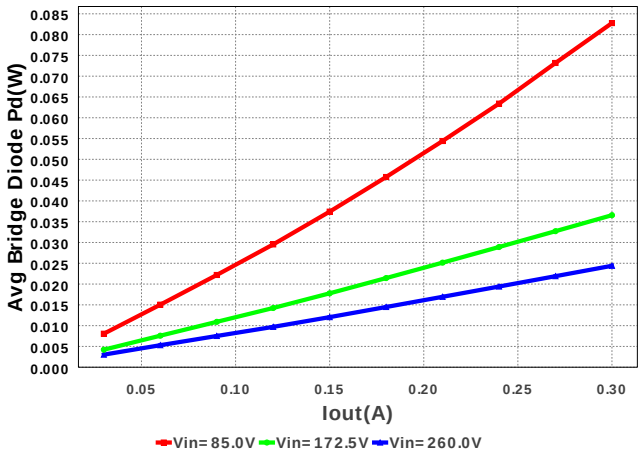




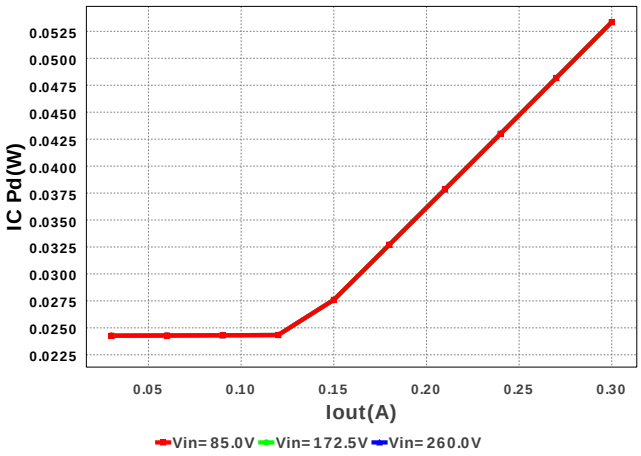
Cout IRMS



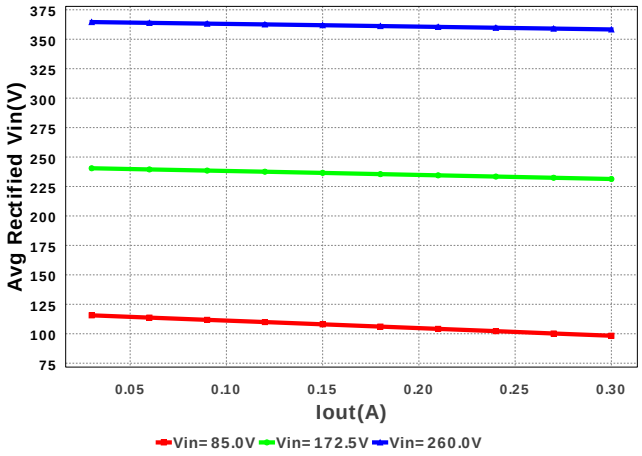
Avg Bridge Diode Pd



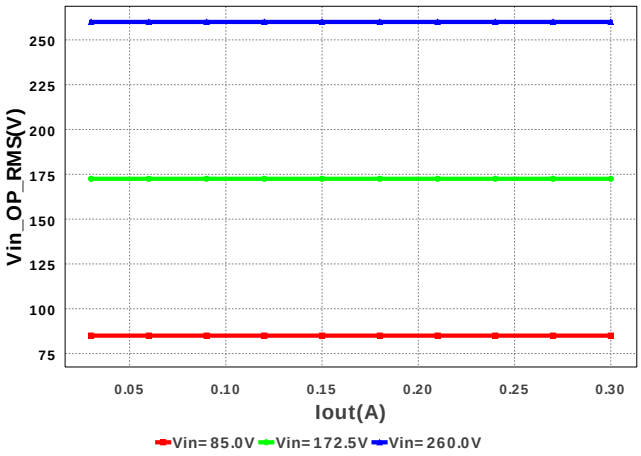
IC Pd



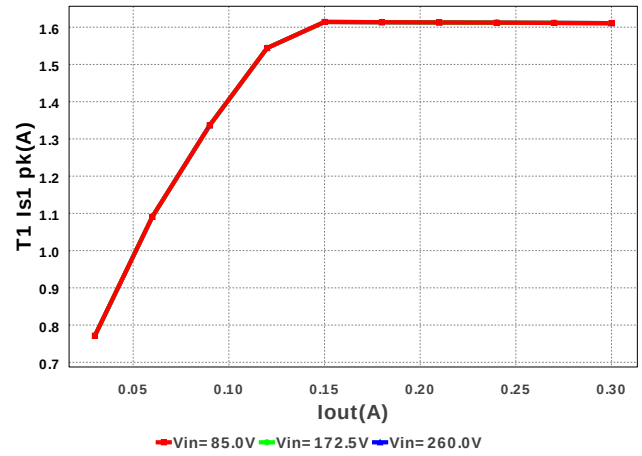
Avg Rectified Vin

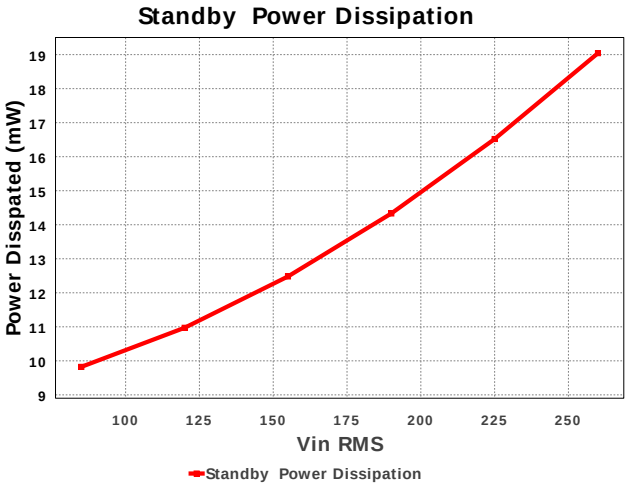


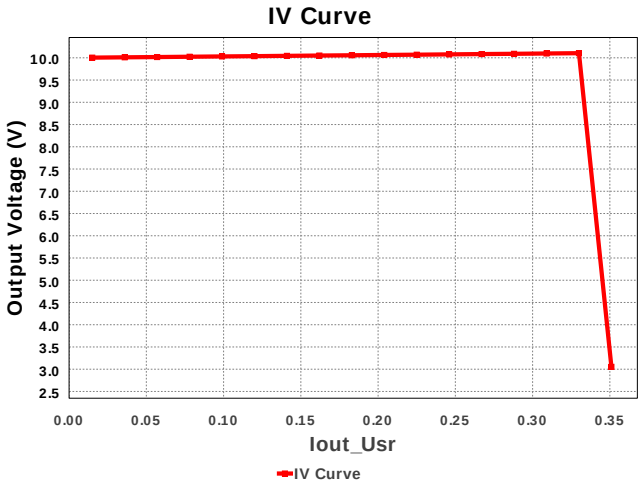
Vin_OP_RMS



T1 Is1 pk







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	13.63 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	52.146 mA	Current	Input capacitor2 RMS ripple current
3.	Cout IRMS	564.908 mA	Current	Output capacitor RMS ripple current
4.	Iin rms	15.38 mA	Current	RMS Input Current
5.	T1 Iprim RMS	39.869 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	231.481 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	567.809 mA	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	1.611 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	356.535 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	30	General	Total Design BOM count
11.	FootPrint	775.0 mm2	General	Total Foot Print Area of BOM components
12.	Mode	DCM	General	Conduction Mode
13.	Pout	3.028 W	General	Total output power
14.	Total BOM	$0.0	General	Total BOM Cost
15.	Vout OP	10.094 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	8.899 %	Op_point	Duty cycle
17.	Efficiency	75.73 %	Op_point	Steady state efficiency
18.	Frequency	101.206 kHz	Op_point	Switching frequency
19.	IC Tj	33.735 degC	Op_point	IC junction temperature
20.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	300.0 mA	Op_point	Iout operating point
22.	M1 TjOP	65.601 degC	Op_point	M1 MOSFET junction temperature
23.	Min Rectified Vin	345.379 V	Op_point	Minimum voltage seen at rectified input
24.	Peak Rectified Vin	367.692 V	Op_point	Peak voltage seen at rectified input
25.	Vin_OP_RMS	260.0 V	Op_point	AC Input RMS Voltage
26.	Vout p-p	41.884 mV	Op_point	Peak-to-peak output ripple voltage
27.	Avg Bridge Diode Pd	24.506 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
28.	Cin Pd	1.579 µW	Power	Input capacitor power dissipation
29.	Cout Pd	8.297 mW	Power	Output capacitor power dissipation
30.	Diode2 Pd	210.144 mW	Power	Diode2 power dissipation
31.	IC Pd	53.358 mW	Power	IC power dissipation
32.	M1 Pd	356.013 mW	Power	M1 MOSFET total power dissipation
33.	Total Pd	970.509 mW	Power	Total Power Dissipation
34.	Xformer Pd	181.108 mW	Power	Transformer power dissipation
35.	Zener Pd	48.024 mW	Power	Zener power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	300.0 mA	Maximum Output Current
2.	Iout1	300.0 mAmps	Output Current #1
3.	VinMax	260.0 V	Maximum input voltage
4.	VinMin	85.0 V	Minimum input voltage
5.	Vout	10.0 V	Output Voltage
6.	Vout1	10.0 Volt	Output Voltage #1
7.	base_pn	UCC28700	National Based Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0 degC	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. 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. **UCC28700** Product Folder : http://www.ti.com/product/ucc28700 : contains the data sheet and other resources.