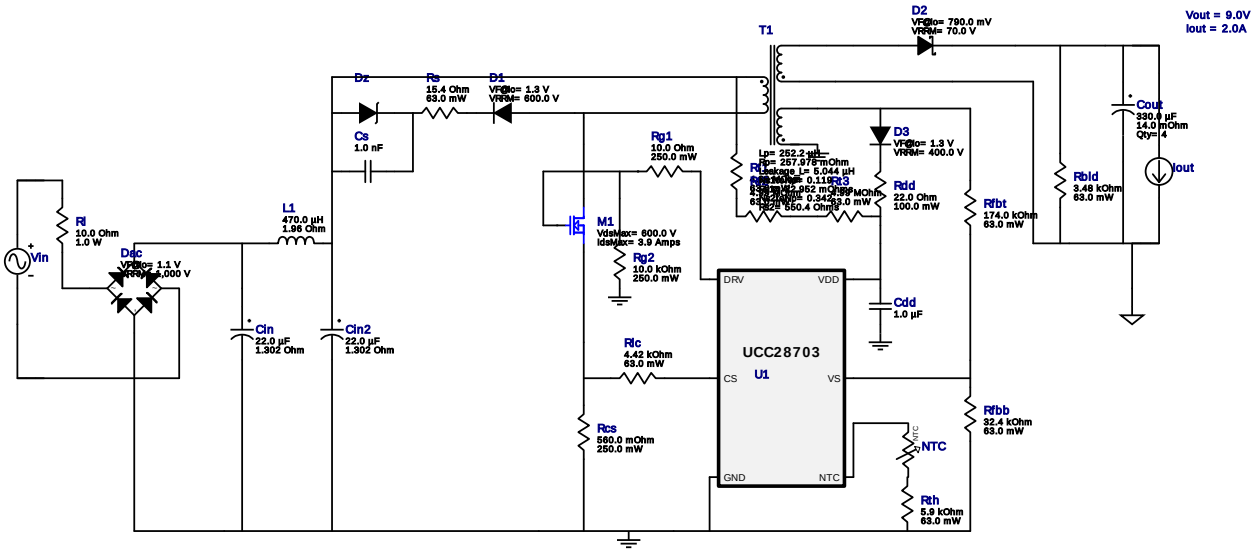
WEBENCH® Design Report

VinMin = 90.0V
VinMax = 260.0V
Vout = 9.0V
Iout = 2.0A

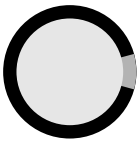
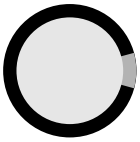
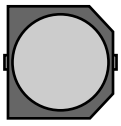
Device = UCC28703DBVR
Topology = Flyback
Created = 6/21/13 1:24:09 AM
BOM Cost = $0.00
BOM Count = 32
Total Pd = 5.57W

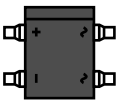
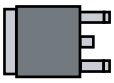
Design : 906020/15 UCC28703DBVR
UCC28703DBVR 90.0V-260.0V to 9.452V @ 2.0A



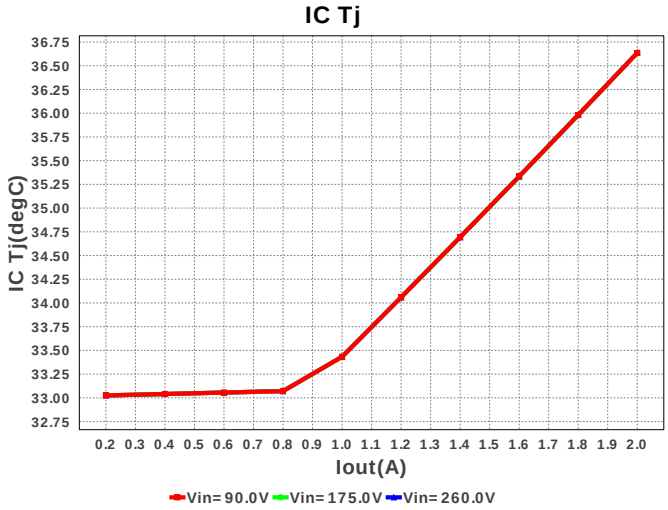
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

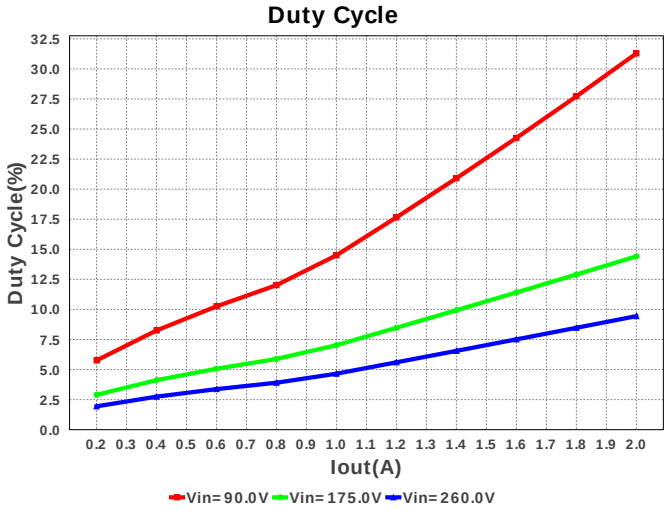
Electrical BOM

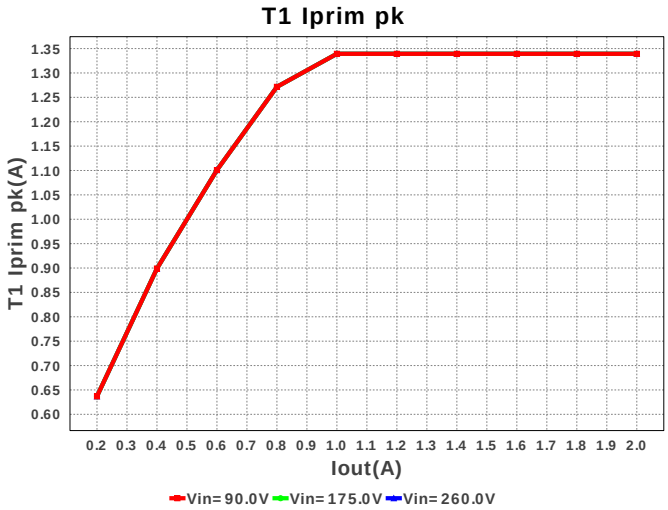
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 35.0 V IRMS= 0.0 A	1	$0.05	 0805 13 mm^2
2.	Cin	Panasonic	EEUED2G220 Series= 286	Cap= 22.0 uF ESR= 1.30218 Ohm VDC= 400.0 V IRMS= 500.0 mA	1	$0.41	 CAPPR5-12.5X25 210 mm^2
3.	Cin2	Panasonic	EEUED2G220 Series= 286	Cap= 22.0 uF ESR= 1.30218 Ohm VDC= 400.0 V IRMS= 500.0 mA	1	$0.41	 CAPPR5-12.5X25 210 mm^2
4.	Cout	Nippon Chemi-Con	APXA160ARA331MJC0G Series= PXA	Cap= 330.0 uF ESR= 14.0 mOhm VDC= 16.0 V IRMS= 5.05 A	4	$1.66	 CAPSMT_62_JC0 156 mm^2
5.	Cs	MuRata	GRM188R72E102KW07D Series= X7R	Cap= 1.0 nF VDC= 250.0 V IRMS= 0.0 A	1	$0.02	 0603 10 mm^2
6.	D1	Bourns	CD214B-F3600	VF@Io= 1.3 V VRRM= 600.0 V	1	NA	 SMB 44 mm^2

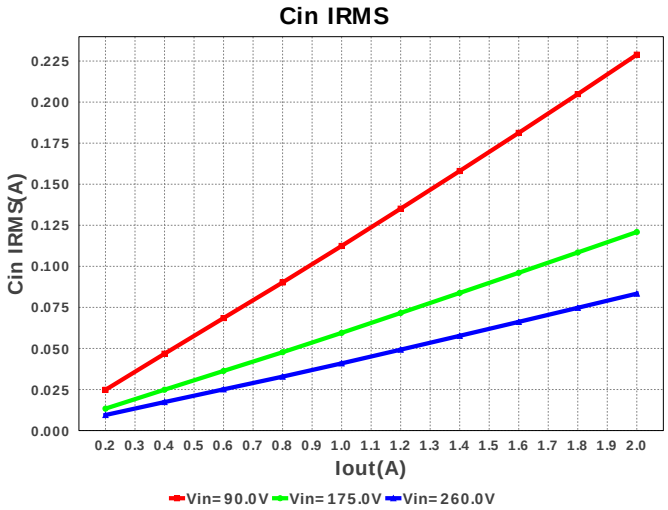
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	D2	Diodes Inc.	B370-13-F	VF@Io= 790.0 mV VRRM= 70.0 V	1	$0.22	 SMC 83 mm²
8.	D3	Diodes Inc.	RS1G-13-F	VF@Io= 1.3 V VRRM= 400.0 V	1	$0.07	 SMA 37 mm²
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	$0.24	 DF-S 99 mm²
10.	Dz	ON Semiconductor	BZG03C150G	Zener	1	$0.13	 SMA 37 mm²
11.	L1	Bourns	SDR0805-471KL	L= 470.0 µH DCR= 1.96 Ohm	1	$0.21	 SDR0805 96 mm²
12.	M1	Fairchild Semiconductor	FCD4N60TM	VdsMax= 600.0 V IdsMax= 3.9 Amps	1	$0.49	 DPAK 102 mm²
13.	Rbld	Vishay-Dale	CRCW04023K48FKED Series= CRCW..e3	Res= 3.48 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8 mm²
14.	Rcs	Panasonic	ERJ-8RQFR56V Series= 229	Res= 560.0 mOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.04	 1206 19 mm²
15.	Rdd	Susumu Co Ltd	RR1220Q-220-D Series= 264	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 0.5%	1	$0.01	 0805 13 mm²
16.	Rfbb	Vishay-Dale	CRCW040232K4FKED Series= CRCW..e3	Res= 32.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8 mm²
17.	Rfbt	Vishay-Dale	CRCW0402174KFKED Series= CRCW..e3	Res= 174.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8 mm²
18.	Rg1	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 19 mm²
19.	Rg2	Panasonic	ERJ-8ENF1002V Series= ERJ-8E	Res= 10.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 19 mm²
20.	Rl	Vishay-Dale	CRCW121810R0FKEK Series= CRCW..e3	Res= 10.0 Ohm Power= 1.0 W Tolerance= 1.0%	1	NA	 1218 0 mm²
21.	Rlc	Vishay-Dale	CRCW04024K42FKED Series= CRCW..e3	Res= 4.42 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8 mm²
22.	Rs	Vishay-Dale	CRCW040215R4FKED Series= CRCW..e3	Res= 15.4 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8 mm²
23.	Rt1	Vishay-Dale	CRCW04024M99FKED Series= CRCW..e3	Res= 4.99 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8 mm²
24.	Rt2	Vishay-Dale	CRCW04024M99FKED Series= CRCW..e3	Res= 4.99 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8 mm²
25.	Rt3	Vishay-Dale	CRCW04024M99FKED Series= CRCW..e3	Res= 4.99 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8 mm²

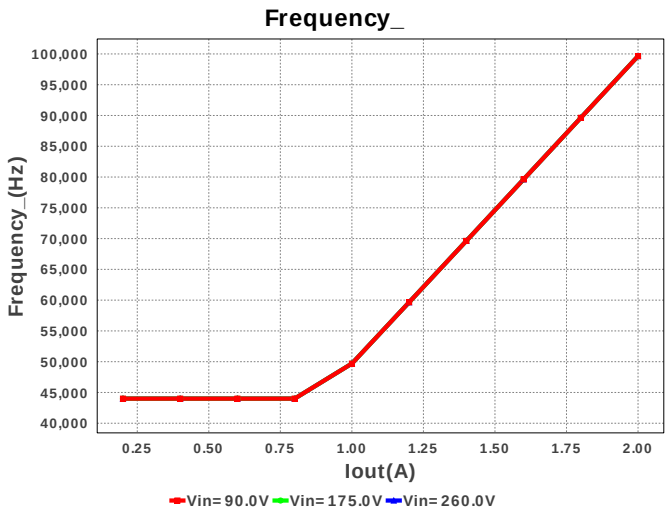
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	Rth	Vishay-Dale	CRCW04025K90FKED Series= CRCW..e3	Res= 5.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 8 mm^2
27.	T1	CUSTOM	CUSTOM	Lp= 252.2 µH Rp= 257.978 mOhm Leakage_L= 5.044 µH Ns1toNp= 0.119 Rs1= 22.952 mOhms Ns2toNp= 0.342 Rs2= 550.4 Ohms	1	NA	CUSTOM 0 mm^2
28.	U1	Texas Instruments	UCC28703DBVR	Switcher	1	$0.35	SOT-23-6 24 mm^2

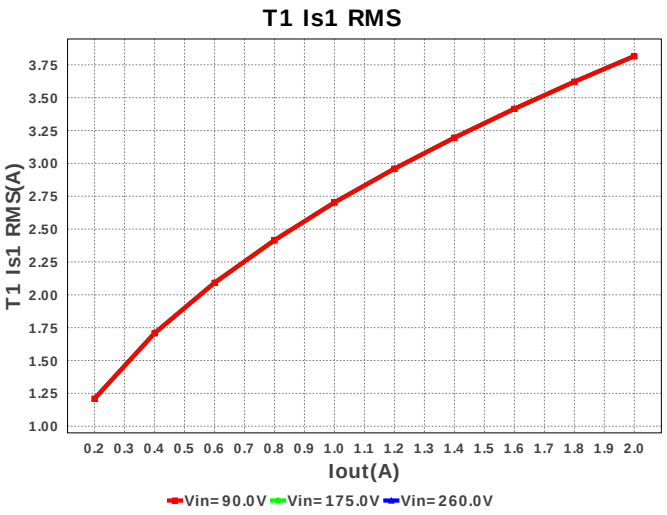


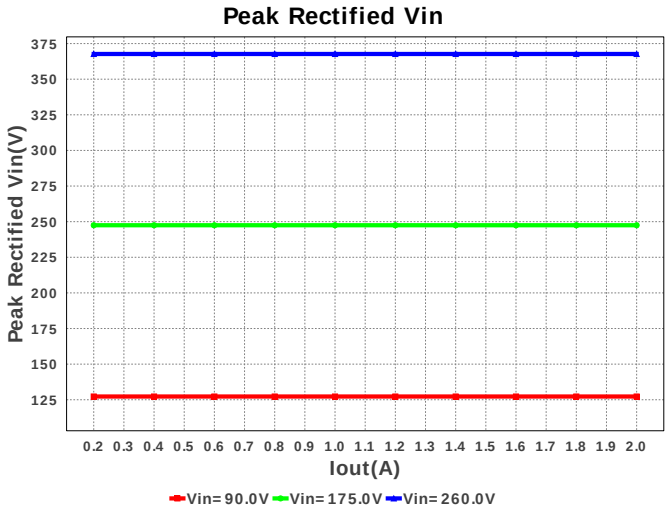


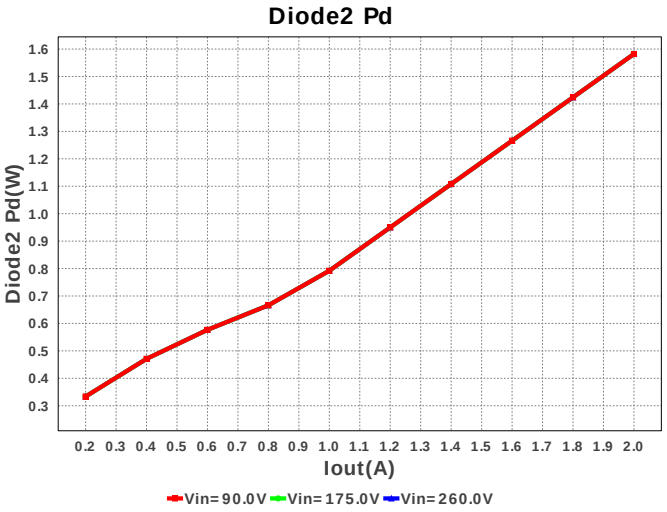


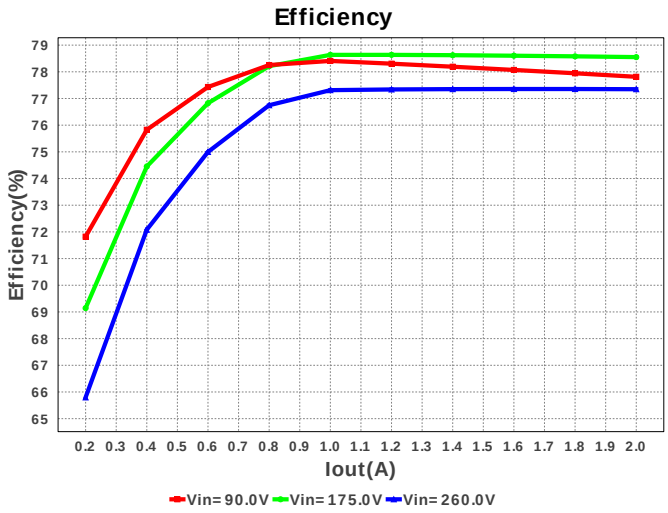


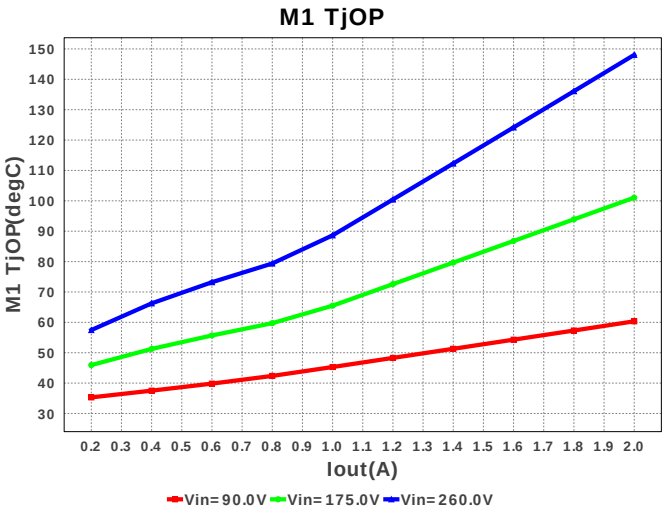


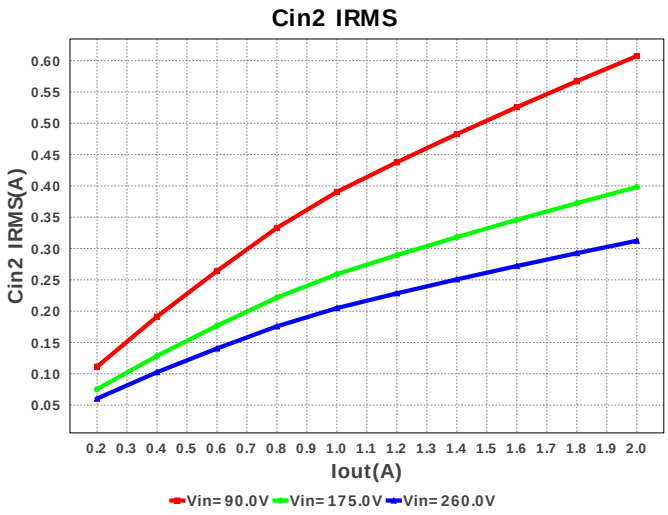


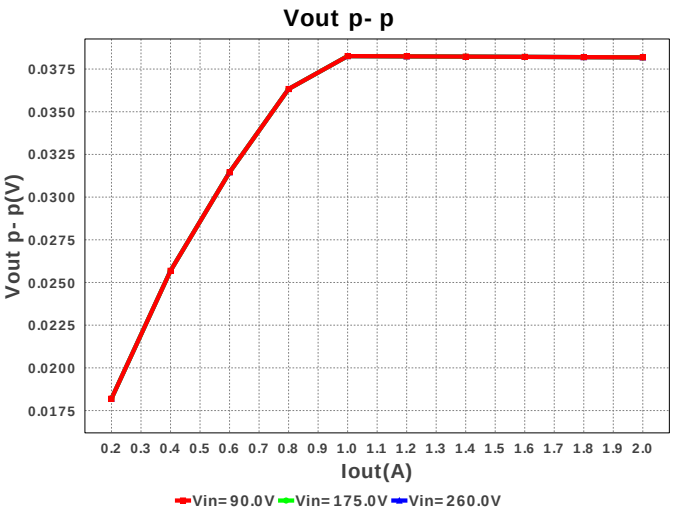


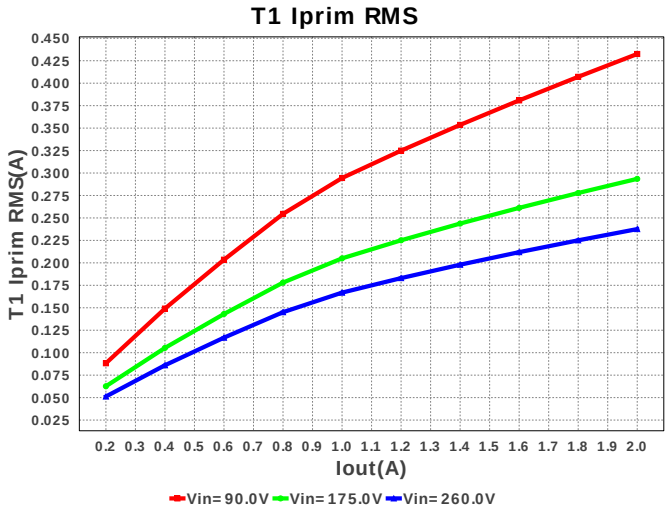


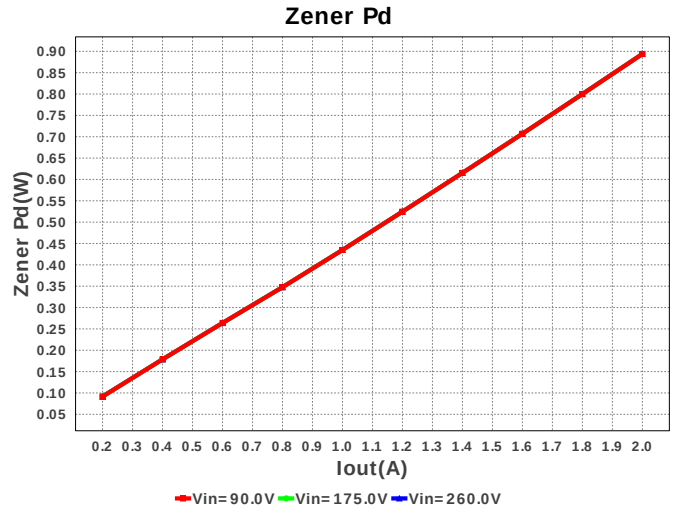


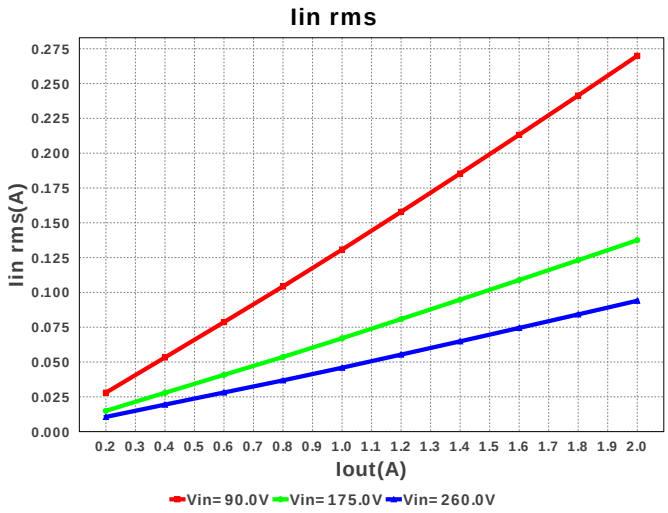


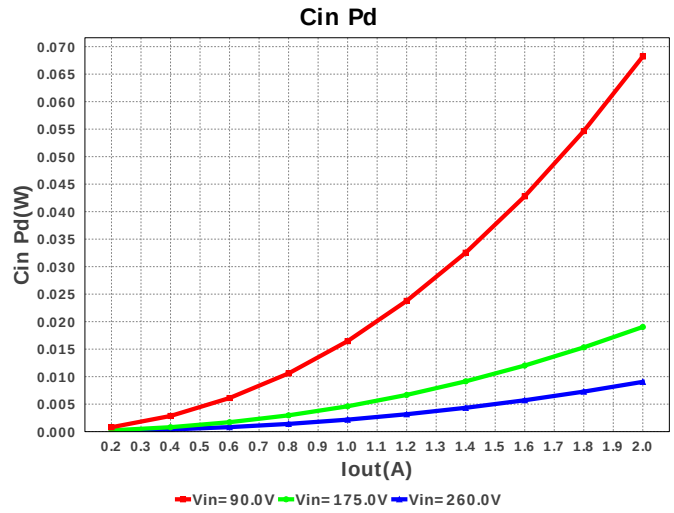


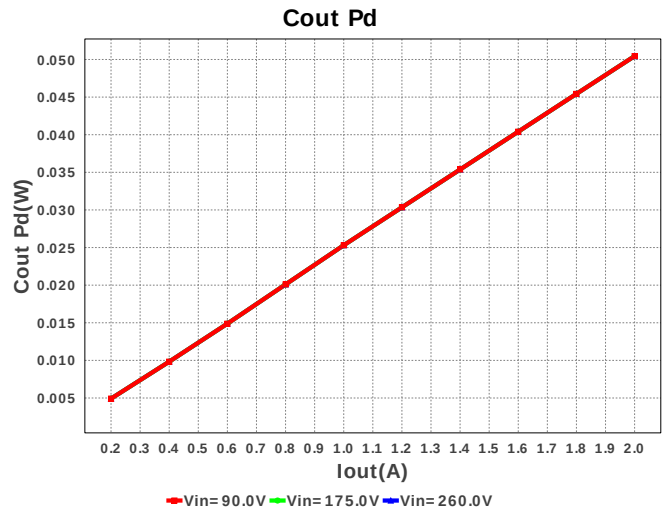


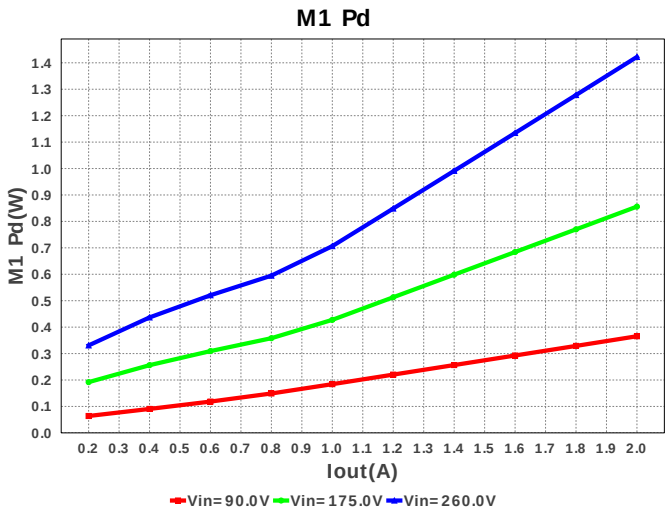


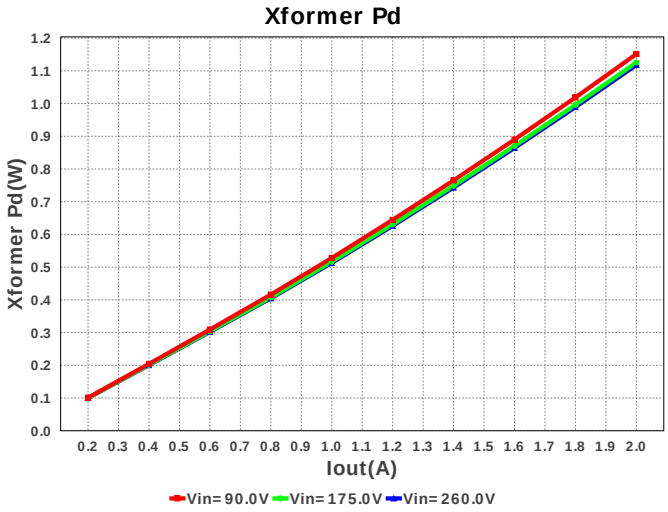


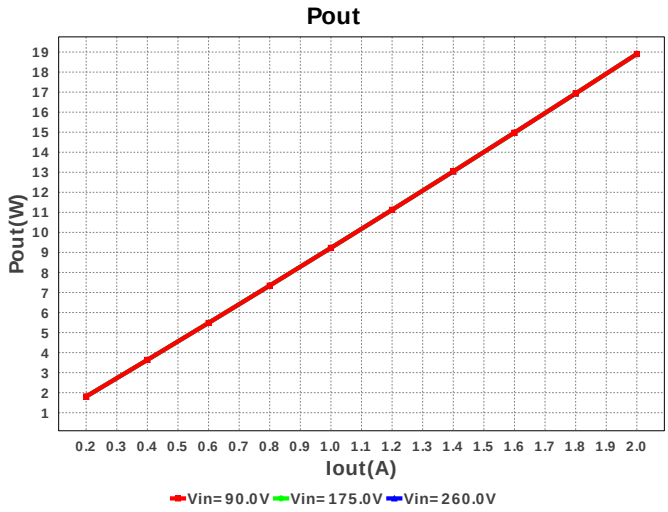


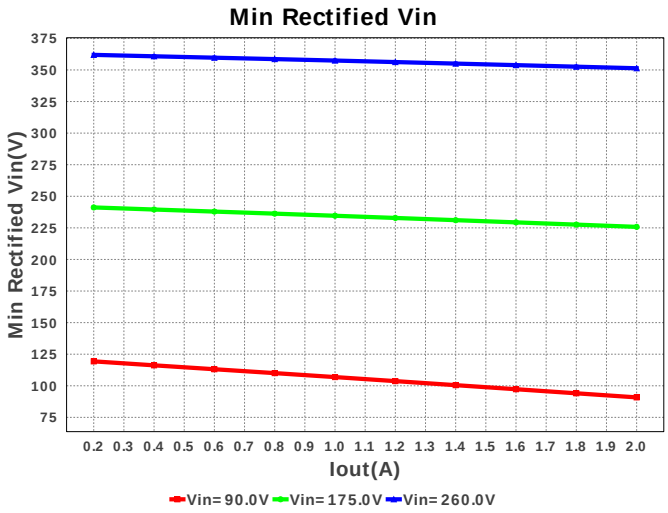


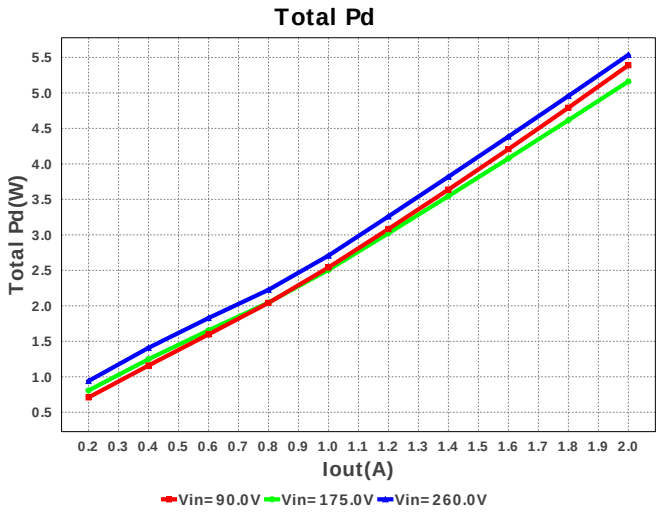


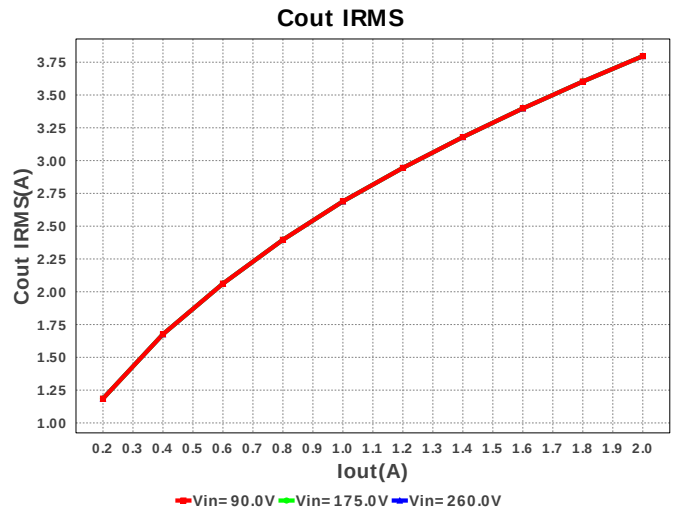


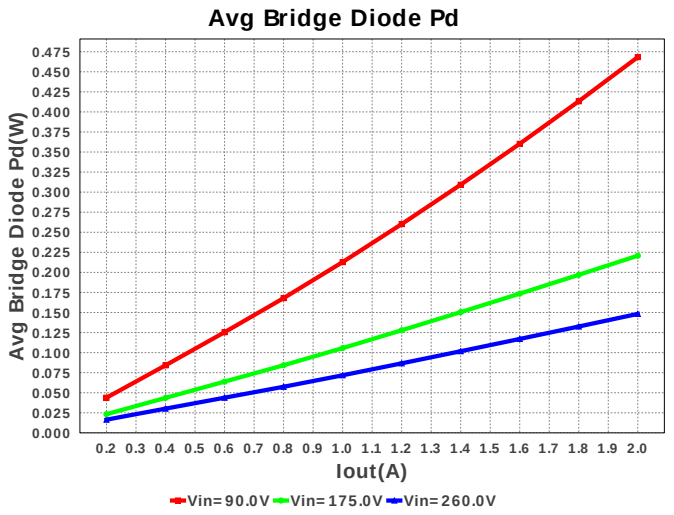


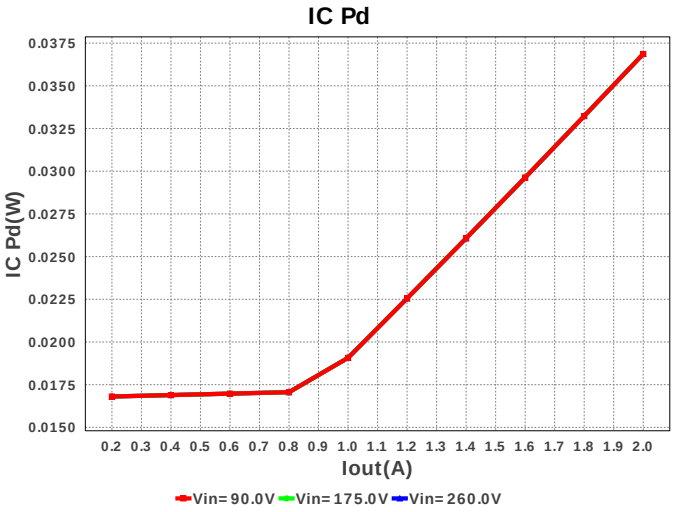


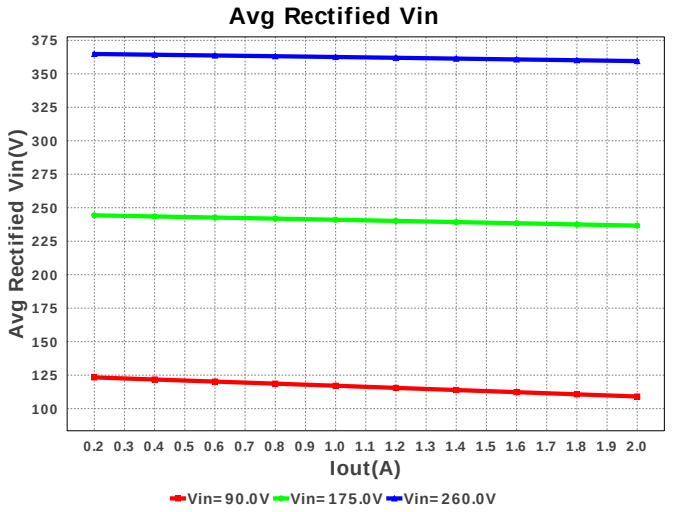


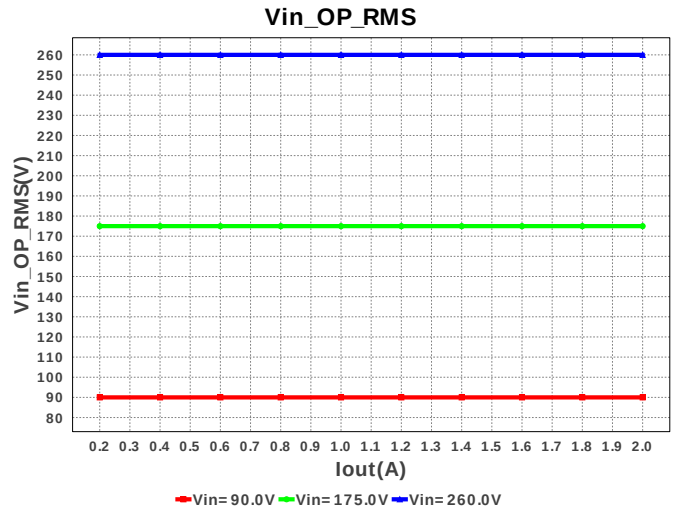


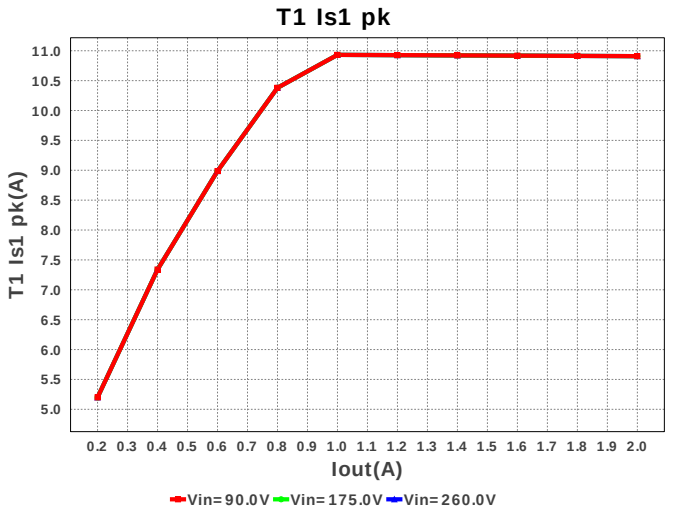


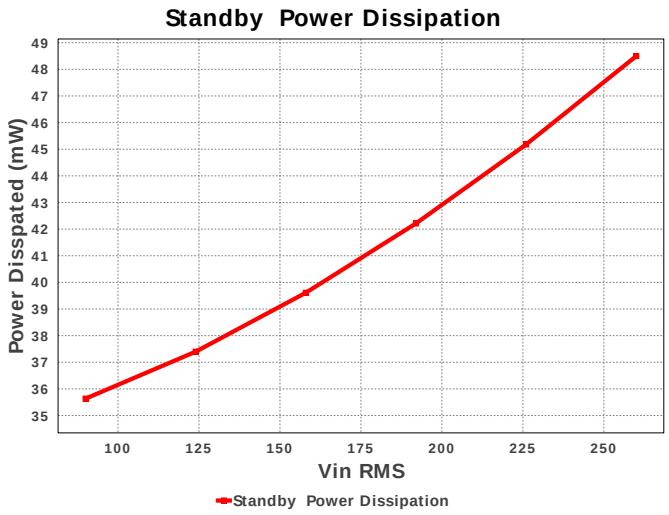


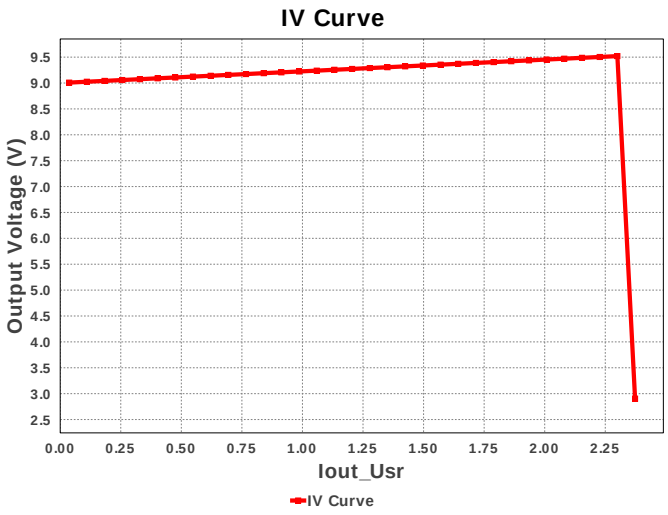












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	83.745 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	314.028 mA	Current	Input capacitor2 RMS ripple current
3.	Cout IRMS	3.797 A	Current	Output capacitor RMS ripple current
4.	Iin rms	94.117 mA	Current	RMS Input Current
5.	T1 Iprim RMS	239.005 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	1.339 A	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	3.816 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	10.909 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	355.882 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	32	General	Total Design BOM count
11.	FootPrint	1.745 k mm^2	General	Total Foot Print Area of BOM components
12.	Pout	18.904 W	General	Total output power
13.	Total BOM	$0.0	General	Total BOM Cost
14.	Vout OP	9.452 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	9.554 %	Op_point	Duty cycle
16.	Efficiency	77.253 %	Op_point	Steady state efficiency
17.	Frequency	99.649 kHz	Op_point	Switching frequency
18.	IC Tj	32.58 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	146.388 degC	Op_point	M1 MOSFET junction temperature
22.	Min Rectified Vin	344.073 V	Op_point	Minimum voltage seen at rectified input
23.	Peak Rectified Vin	367.692 V	Op_point	Peak voltage seen at rectified input
24.	Vin_OP_RMS	260.0 V	Op_point	AC Input RMS Voltage
25.	Vout p-p	38.183 mV	Op_point	Peak-to-peak output ripple voltage
26.	Avg Bridge Diode Pd	149.914 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
27.	Cin Pd	9.133 mW	Power	Input capacitor power dissipation
28.	Cout Pd	50.449 mW	Power	Output capacitor power dissipation
29.	Diode2 Pd	1.582 W	Power	Diode2 power dissipation
30.	IC Pd	36.864 mW	Power	IC power dissipation
31.	M1 Pd	1.402 W	Power	M1 MOSFET total power dissipation
32.	Total Pd	5.566 W	Power	Total Power Dissipation
33.	Xformer Pd	1.118 W	Power	Transformer power dissipation
34.	Zener Pd	893.785 mW	Power	Zener power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	Iout1	2.0	Output Current #1
3.	VinMax	260.0	Maximum input voltage
4.	VinMin	90.0	Minimum input voltage
5.	Vout	9.0	Output Voltage
6.	Vout1	9.0	Output Voltage #1
7.	base_pn	UCC28703	Base Product Number
8.	source	DC	Input Source Type
9.	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. 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.