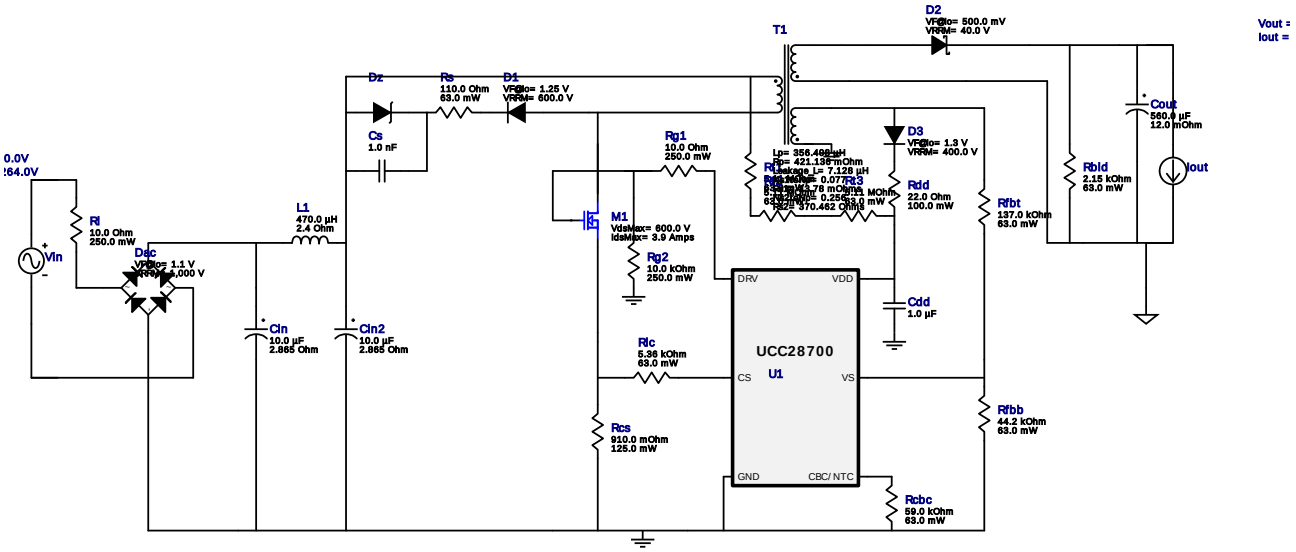
WEBENCH® Design Report

VinMin = 90.0V
VinMax = 264.0V
Vout = 5.0V
Iout = 2.0A

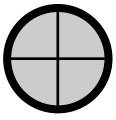
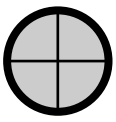
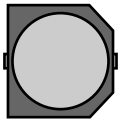
Device = UCC28700DBVR
Topology = Flyback
Created = 5/3/13 12:00:02 AM
BOM Cost = $0.00
Total Pd = 3.63W
Footprint = 1,594.0mm2
BOM Count = 31

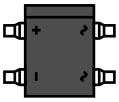
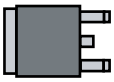
Design : 3728439/10 UCC28700DBVR
UCC28700DBVR 90.0V-264.0V to 5.134V @ 2.0A



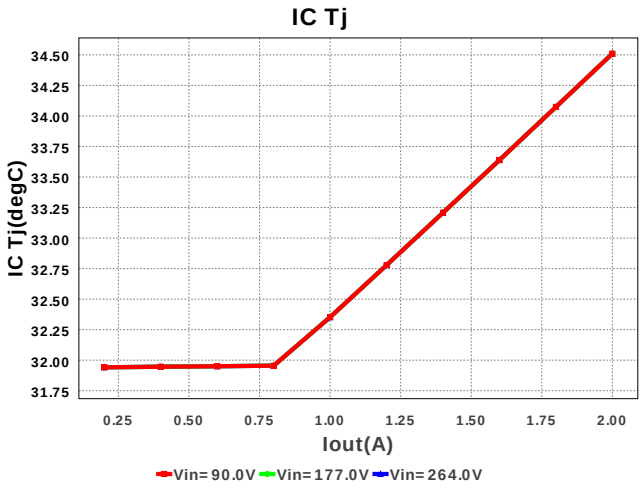
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

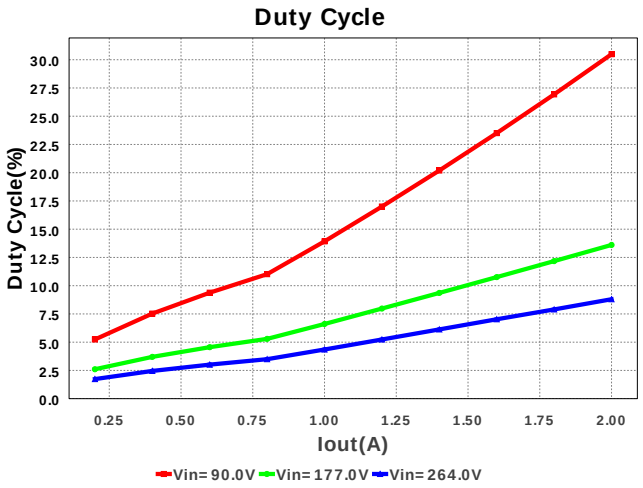
Electrical BOM

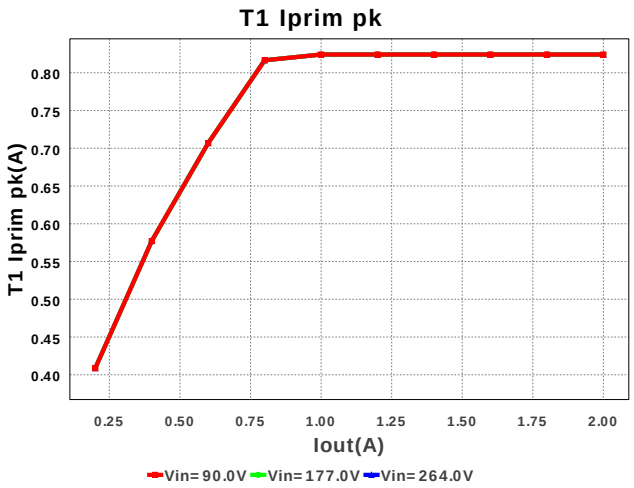
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 µF VDC= 25.0 V IRMS= 0.0 A	1	$0.02	 0603 10mm2
2.	Cin	Panasonic	EEUED2G100 Series= 286	Cap= 10.0 µF ESR= 2.865 Ohm VDC= 400.0 V IRMS= 300.0 mA	1	$0.22	 CAPPR5-10X20 144mm2
3.	Cin2	Panasonic	EEUED2G100 Series= 286	Cap= 10.0 µF ESR= 2.865 Ohm VDC= 400.0 V IRMS= 300.0 mA	1	$0.22	 CAPPR5-10X20 144mm2
4.	Cout	Nippon Chemi-Con	APXA100ARA561MJC0G Series= PXA	Cap= 560.0 µF ESR= 12.0 mOhm VDC= 10.0 V IRMS= 5.3 A	4	$1.57	 CAPSMT_62_JC0 156mm2
5.	Cs	MuRata	GRM155R72A102KA01D Series= X7R	Cap= 1.0 nF VDC= 100.0 V IRMS= 0.0 A	1	$0.01	 0402 8mm2
6.	D1	Diodes Inc.	MURS160-13-F	VF@Io= 1.25 V VRRM= 600.0 V	1	$0.11	 SMB 44mm2
7.	D2	Vishay-Semiconductor	SS34-E3/57T	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.18	 SMC 83mm2

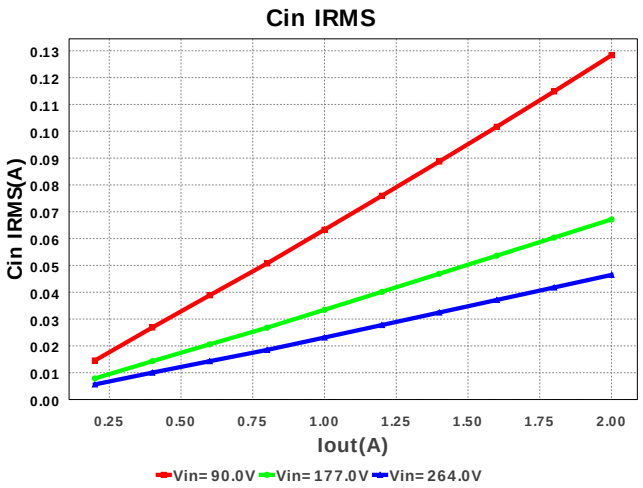
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	D3	Diodes Inc.	RS1G-13-F	VF@Io= 1.3 V VRRM= 400.0 V	1	$0.07	 SMA 37mm2
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000 V	1	$0.14	 DF-S 99mm2
10.	Dz	ON Semiconductor	1SMB5946BT3G	Zener	1	$0.08	 SMB 44mm2
11.	L1	Bourns	SRR7032-471M	L= 470.0 µH DCR= 2.4 Ohm	1	$0.25	 SRR7032 81mm2
12.	M1	Fairchild Semiconductor	FCD4N60TM	VdsMax= 600.0 V IdsMax= 3.9 Amps	1	$0.49	 DPAK 102mm2
13.	Rbld	Vishay-Dale	CRCW04022K15FKED Series= CRCW..e3	Res= 2.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
14.	Rcbc	Vishay-Dale	CRCW040259K0FKED Series= CRCW..e3	Res= 59.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
15.	Rcs	Panasonic	ERJ-2BQFR91X Series= 226	Res= 910.0 mOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.06	 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	CRCW040244K2FKED Series= CRCW..e3	Res= 44.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
18.	Rfbt	Vishay-Dale	CRCW0402137KFKED Series= CRCW..e3	Res= 137.0 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	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 19mm2
22.	Rlc	Vishay-Dale	CRCW04025K36FKED Series= CRCW..e3	Res= 5.36 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
23.	Rs	Vishay-Dale	CRCW0402110RFKED Series= CRCW..e3	Res= 110.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
24.	Rt1	Vishay-Dale	CRCW04025M11FKED Series= CRCW..e3	Res= 5.11 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
25.	Rt2	Vishay-Dale	CRCW04025M11FKED Series= CRCW..e3	Res= 5.11 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
26.	Rt3	Vishay-Dale	CRCW04025M11FKED Series= CRCW..e3	Res= 5.11 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2

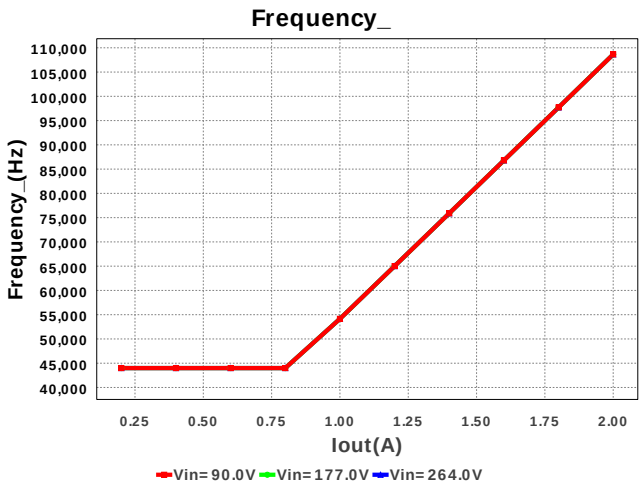
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	T1	CUSTOM	CUSTOM	Lp= 356.408 µH Rp= 421.136 mOhm Leakage_L= 7.128 µH Ns1toNp= 0.077 Rs1= 13.78 mOhms Ns2toNp= 0.256 Rs2= 370.462 Ohms	1	NA	CUSTOM 0mm2
28.	U1	Texas Instruments	UCC28700DBVR	Switcher	1	$0.35	SOT-23-6 24mm2

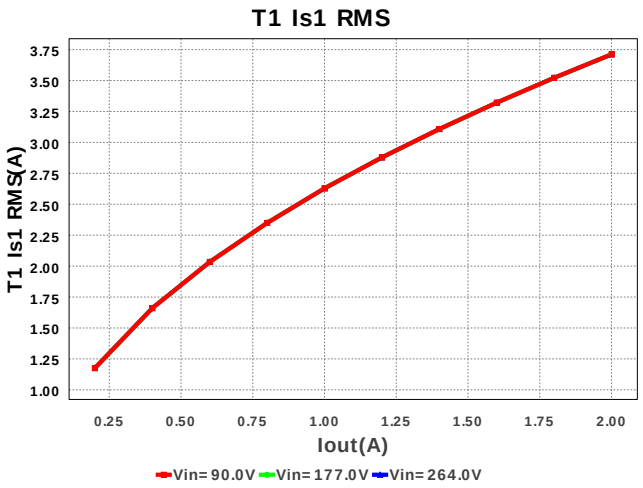




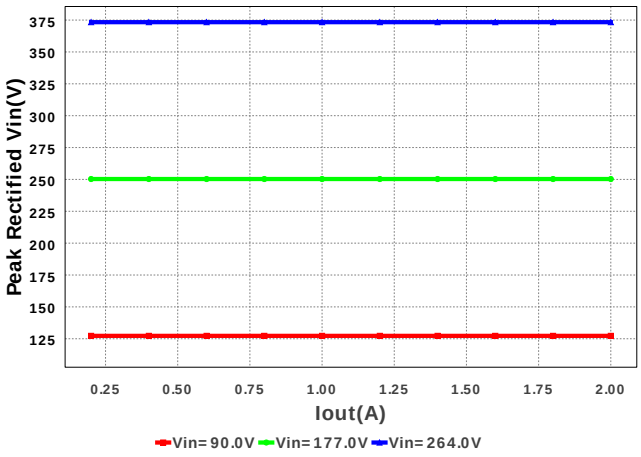




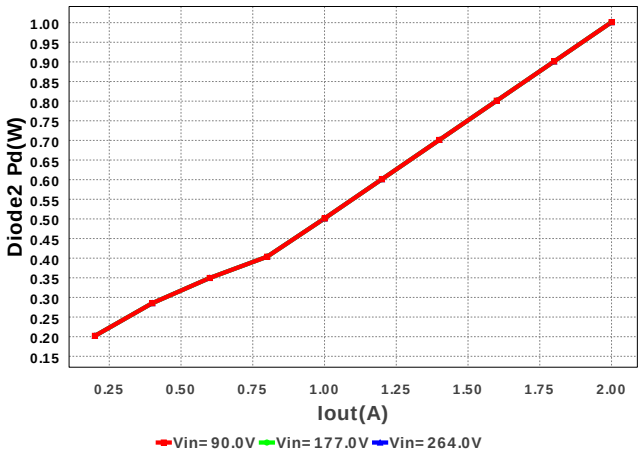




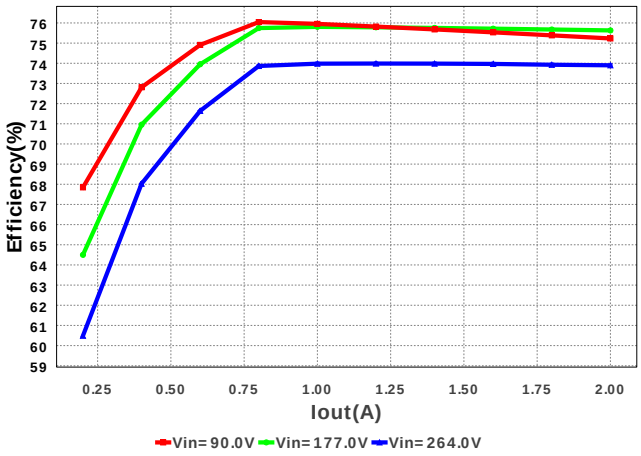
Peak Rectified Vin



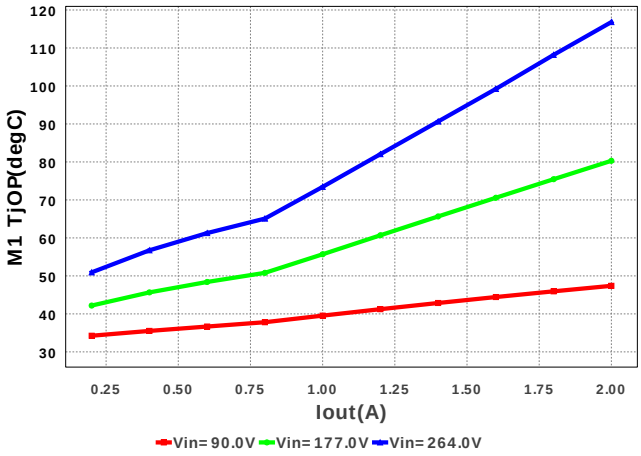
Diode2 Pd



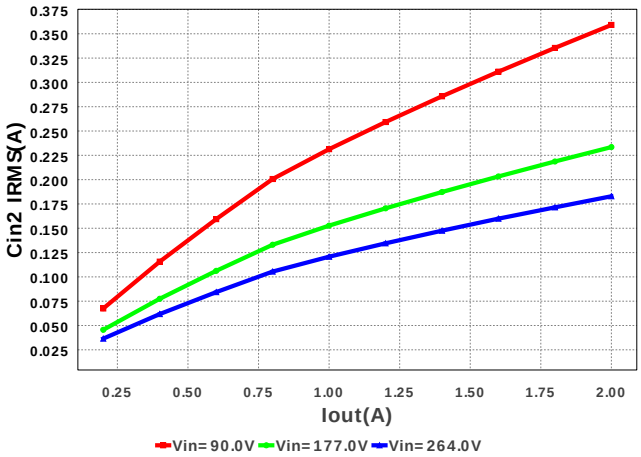
Efficiency



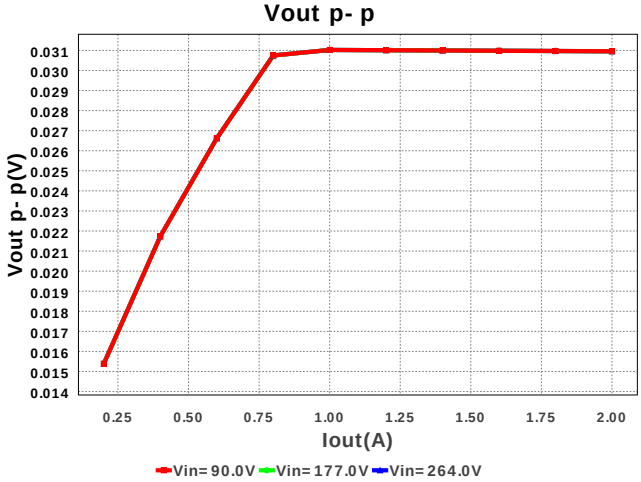
M1 TjOP

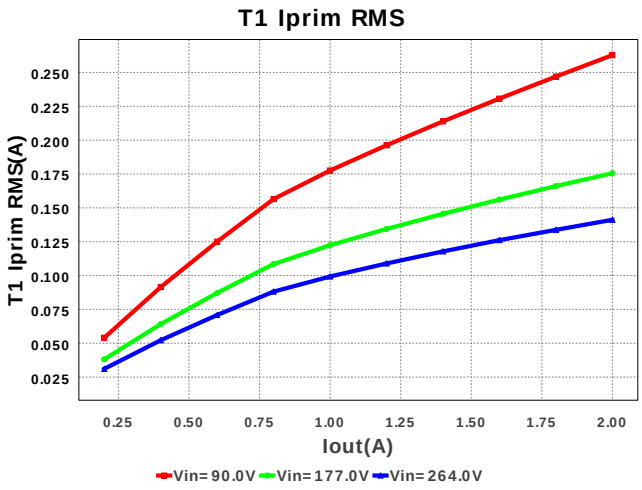


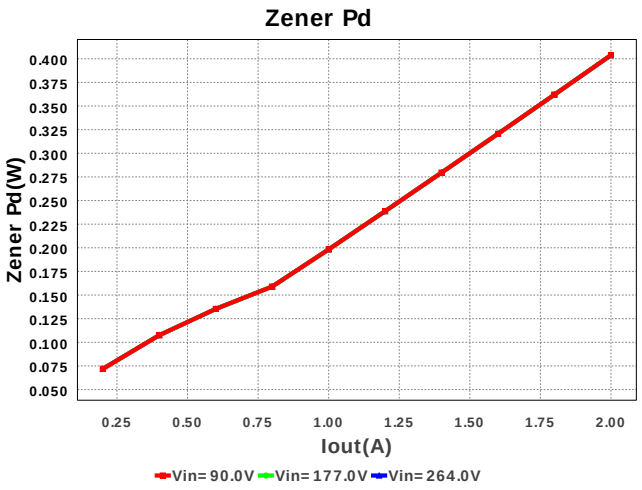
Cin2 IRMS

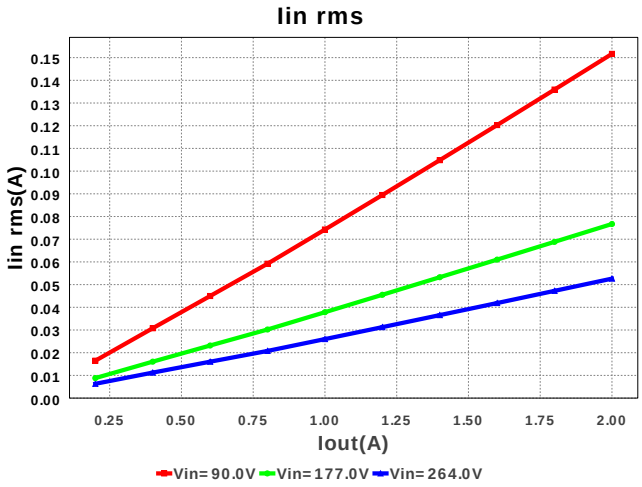


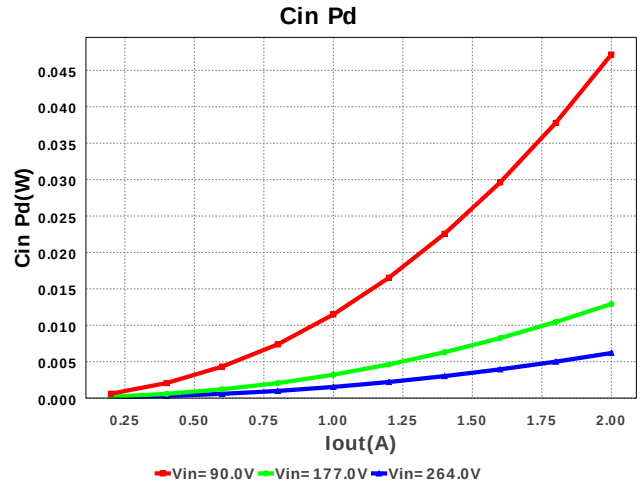
Vout p- p

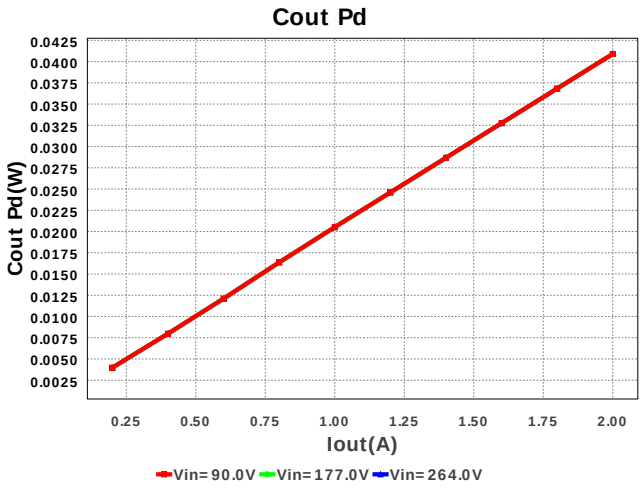


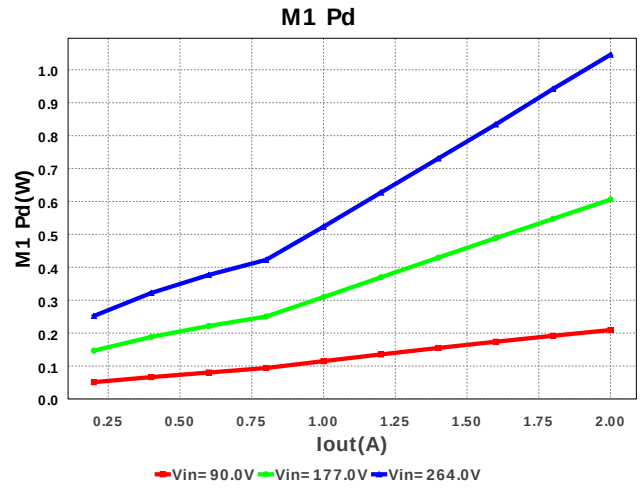


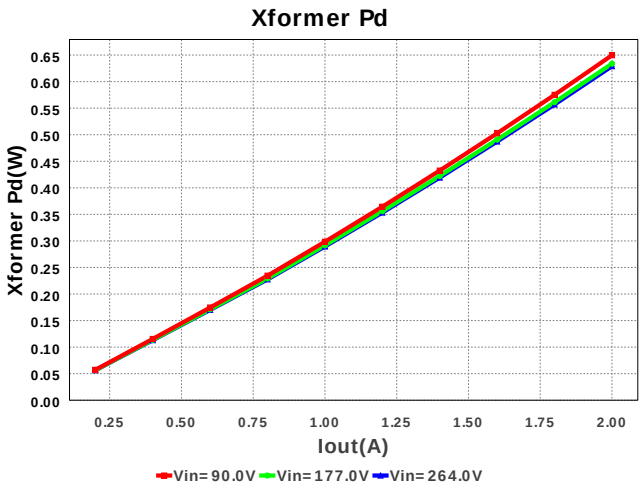


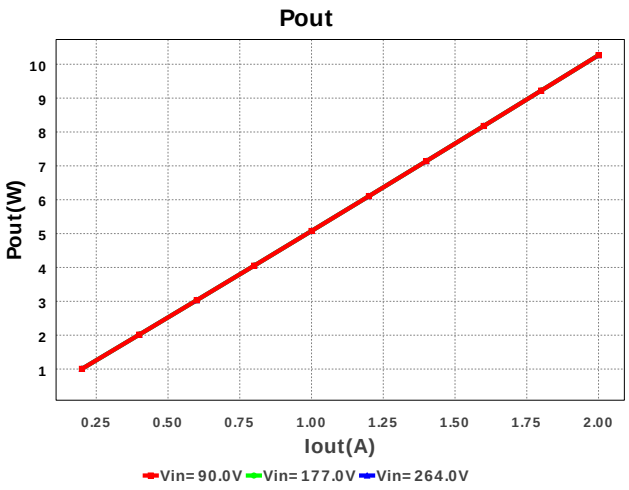


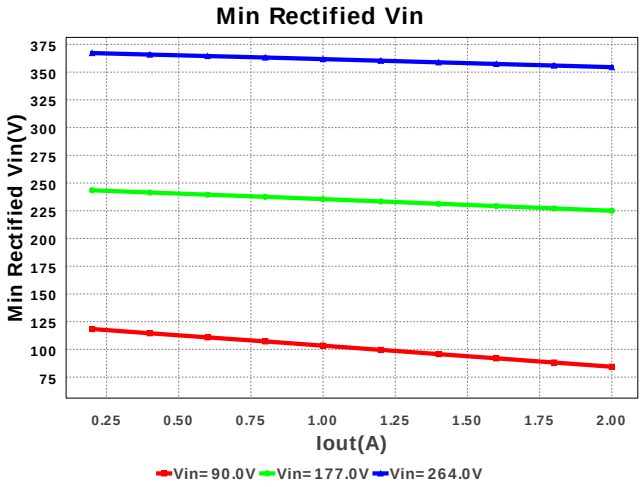


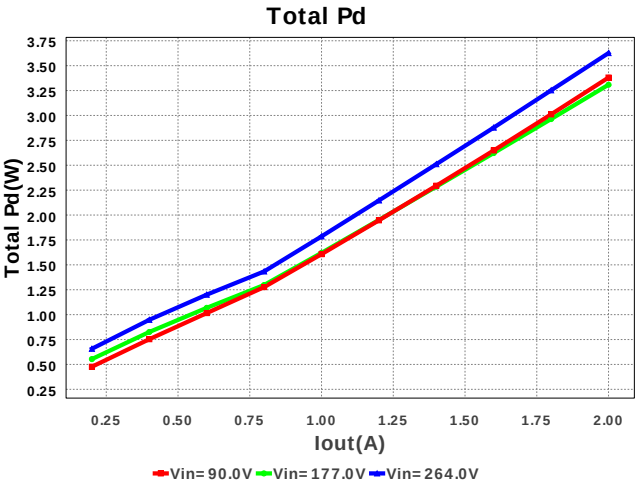


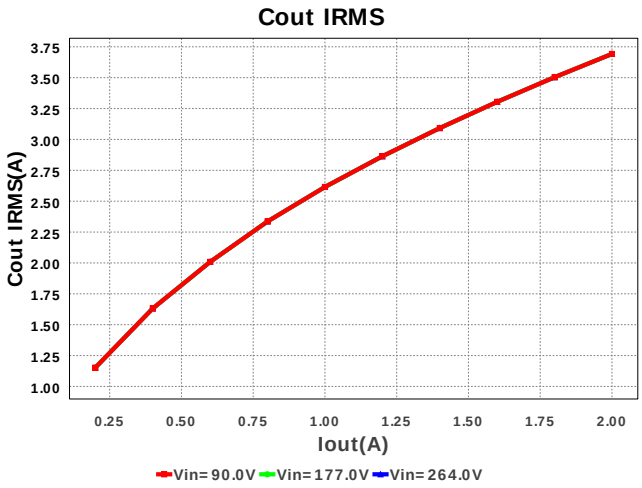


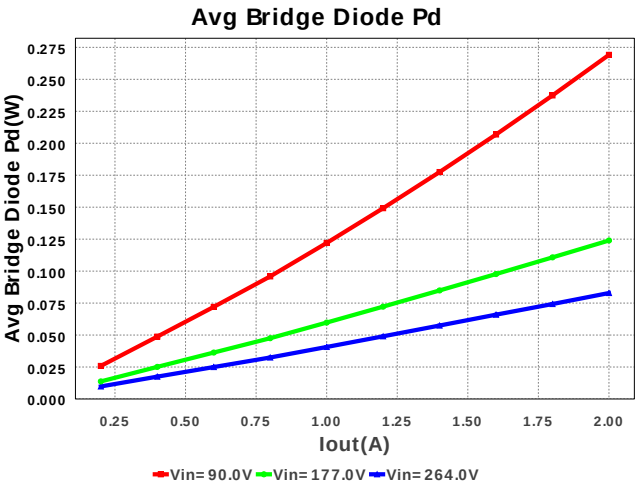


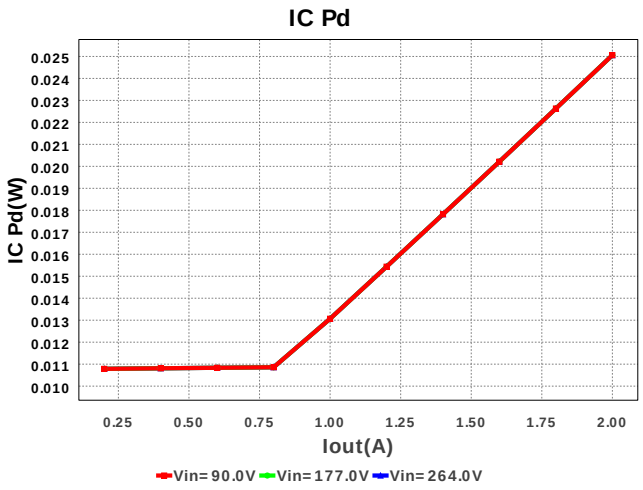


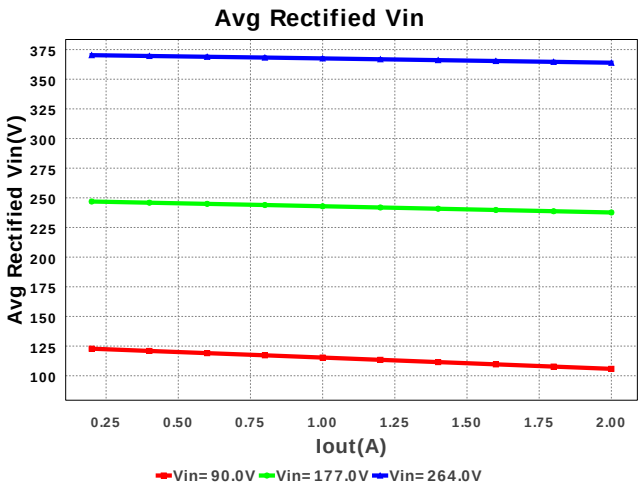


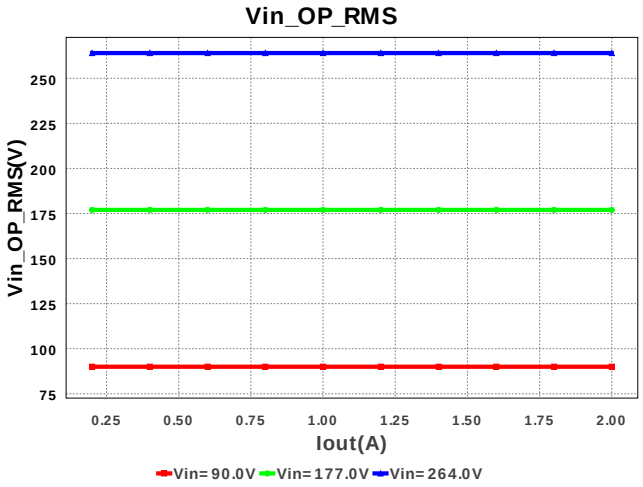


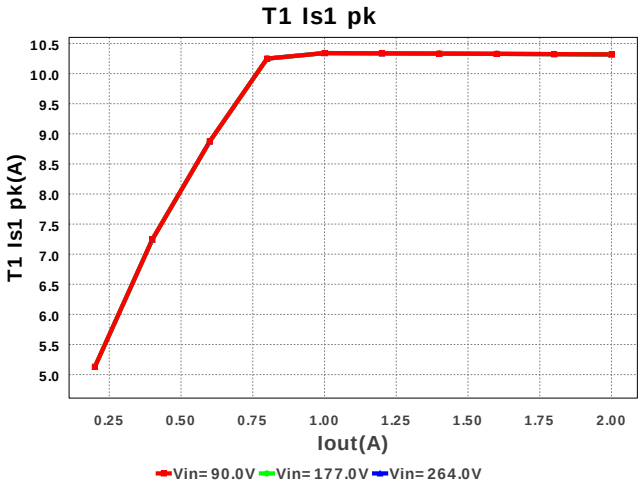


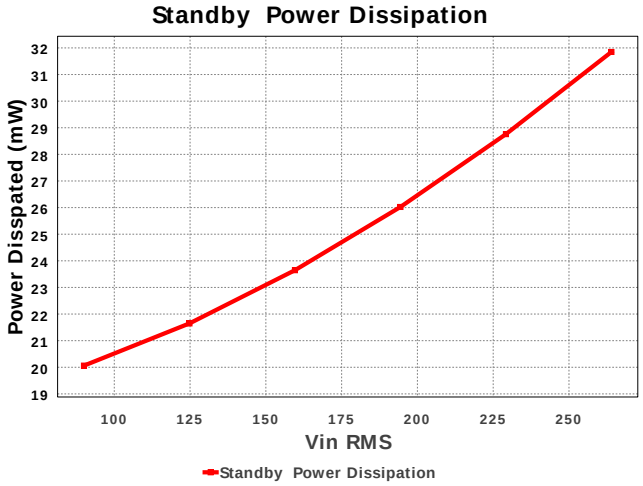


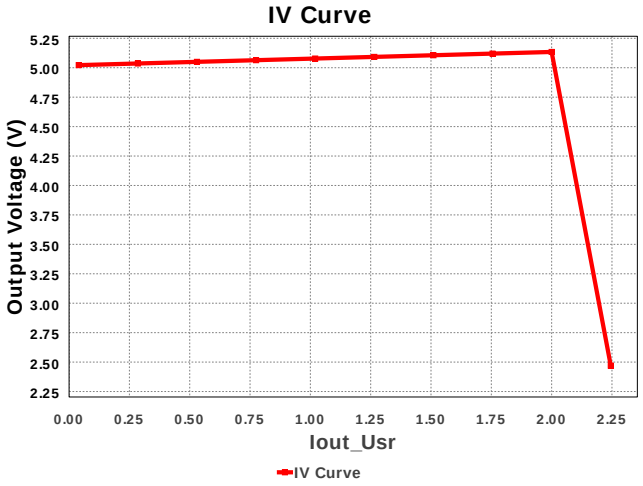












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	46.594 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	183.889 mA	Current	Input capacitor2 RMS ripple current
3.	Cout IRMS	3.692 A	Current	Output capacitor RMS ripple current
4.	Iin rms	52.63 mA	Current	RMS Input Current
5.	T1 Iprim RMS	142.132 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	824.176 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	3.711 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	10.319 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	361.085 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	31	General	Total Design BOM count
11.	FootPrint	1.594 kmm2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Mode	DCM	General	Conduction Mode
13.	Pout	10.268 W	General	Total output power
14.	Total BOM	$0.0	General	Total BOM Cost
15.	Vout OP	5.134 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	8.922 %	Op_point	Duty cycle
17.	Efficiency	73.901 %	Op_point	Steady state efficiency
18.	Frequency	108.64 kHz	Op_point	Switching frequency
19.	IC Tj	31.754 degC	Op_point	IC junction temperature
20.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	2.0 A	Op_point	Iout operating point
22.	M1 TjOP	115.364 degC	Op_point	M1 MOSFET junction temperature
23.	Min Rectified Vin	348.821 V	Op_point	Minimum voltage seen at rectified input
24.	Peak Rectified Vin	373.349 V	Op_point	Peak voltage seen at rectified input
25.	Vin_OP_RMS	264.0 V	Op_point	AC Input RMS Voltage
26.	Vout p-p	30.956 mV	Op_point	Peak-to-peak output ripple voltage
27.	Avg Bridge Diode Pd	83.917 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
28.	Cin Pd	6.22 mW	Power	Input capacitor power dissipation
29.	Cout Pd	40.896 mW	Power	Output capacitor power dissipation
30.	Diode2 Pd	1.001 W	Power	Diode2 power dissipation
31.	IC Pd	25.058 mW	Power	IC power dissipation
32.	M1 Pd	1.028 W	Power	M1 MOSFET total power dissipation
33.	Total Pd	3.626 W	Power	Total Power Dissipation
34.	Xformer Pd	629.289 mW	Power	Transformer power dissipation
35.	Zener Pd	403.813 mW	Power	Zener power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	2.0 A	Maximum Output Current
2.	Iout1	2.0 Amps	Output Current #1
3.	VinMax	264.0 V	Maximum input voltage
4.	VinMin	90.0 V	Minimum input voltage
5.	Vout	5.0 V	Output Voltage
6.	Vout1	5.0 Volt	Output Voltage #1
7.	base_pn	UCC28700	National Based Product Number
8.	source	AC	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.