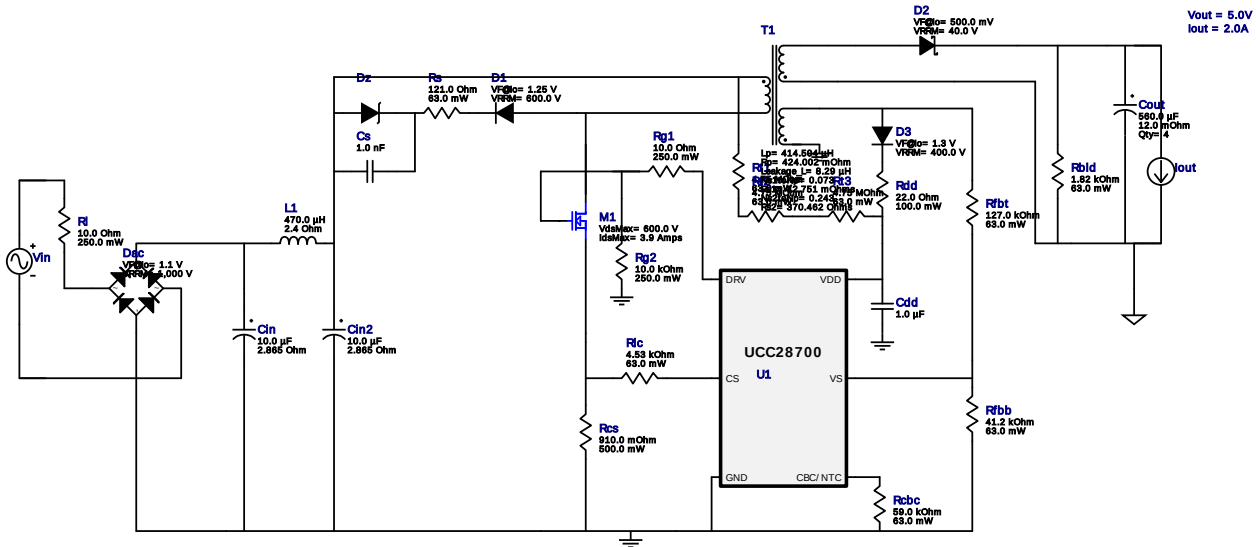


WEBENCH® Design Report

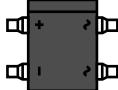
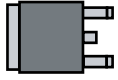
Design : 906020/11 UCC28700DBVR
UCC28700DBVR 86.0V-256.0V to 5.107V @ 2.0A



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.

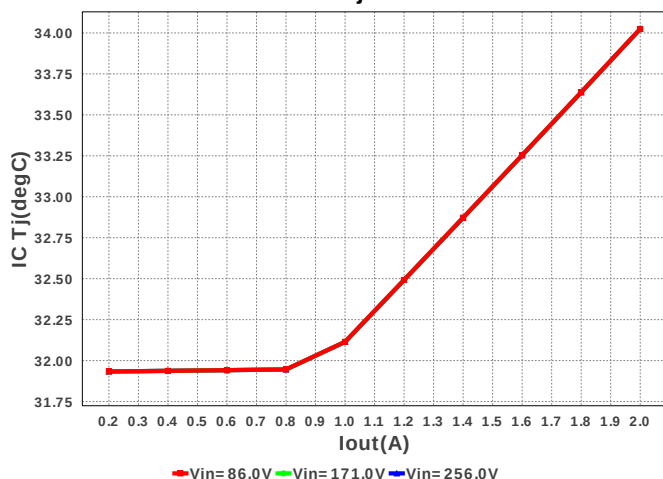
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF VDC= 25.0 V IRMS= 0.0 A	1	\$0.02	0603 10 mm ²
2.	Cin	Panasonic	EEUED2G100 Series= 286	Cap= 10.0 uF ESR= 2.8648 Ohm VDC= 400.0 V IRMS= 300.0 mA	1	\$0.22	CAPPR5-10X20 144 mm ²
3.	Cin2	Panasonic	EEUED2G100 Series= 286	Cap= 10.0 uF ESR= 2.8648 Ohm VDC= 400.0 V IRMS= 300.0 mA	1	\$0.22	CAPPR5-10X20 144 mm ²
4.	Cout	Nippon Chemi-Con	APXA100ARA561MJC0G Series= PXA	Cap= 560.0 uF ESR= 12.0 mOhm VDC= 10.0 V IRMS= 5.3 A	4	\$1.57	CAPSMT_62_JC0 156 mm ²
5.	Cs	MuRata	GRM155R72A102KA01D Series= X7R	Cap= 1.0 nF VDC= 100.0 V IRMS= 0.0 A	1	\$0.01	0402 8 mm ²
6.	D1	Diodes Inc.	MURS160-13-F	VF@Io= 1.25 V VRRM= 600.0 V	1	\$0.11	SMB 44 mm ²
7.	D2	Vishay-Semiconductor	SS34-E3/57T	VF@Io= 500.0 mV VRRM= 40.0 V	1	\$0.18	SMC 83 mm ²

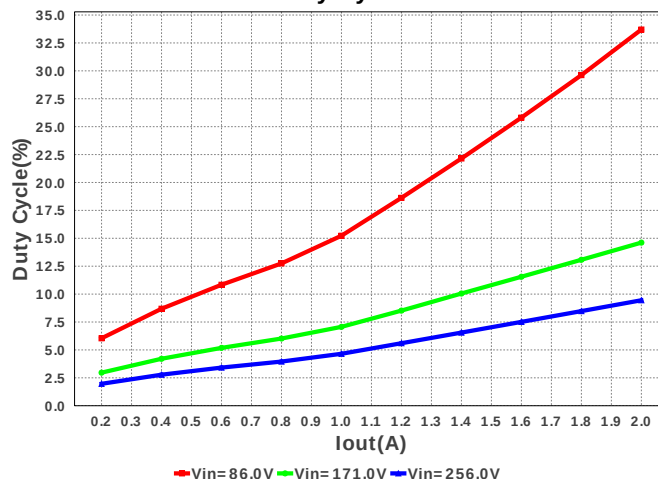
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	D3	Diodes Inc.	RS1G-13-F	VF@Io= 1.3 V VRRM= 400.0 V	1	\$0.07	 SMA 37 mm ²
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	\$0.24	 DF-S 99 mm ²
10.	Dz	ON Semiconductor	1SMB5947BT3G	Zener	1	\$0.07	 SMB 44 mm ²
11.	L1	Bourns	SRR7032-471M	L= 470.0 µH DCR= 2.4 Ohm	1	\$0.25	 SRR7032 81 mm ²
12.	M1	Fairchild Semiconductor	FCD4N60TM	VdsMax= 600.0 V IdsMax= 3.9 Amps	1	\$0.49	 DPAK 102 mm ²
13.	Rbld	Vishay-Dale	CRCW04021K82FKED Series= CRCW..e3	Res= 1.82 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 8 mm ²
14.	Rcbc	Vishay-Dale	CRCW040259K0FKED Series= CRCW..e3	Res= 59.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 8 mm ²
15.	Rcs	Rohm	MCR25JZHFLR910 Series= 298	Res= 910.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.04	 1210 23 mm ²
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 13 mm ²
17.	Rfbb	Vishay-Dale	CRCW040241K2FKED Series= CRCW..e3	Res= 41.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 8 mm ²
18.	Rfbt	Vishay-Dale	CRCW0402127KFKED Series= CRCW..e3	Res= 127.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 8 mm ²
19.	Rg1	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 19 mm ²
20.	Rg2	Panasonic	ERJ-8ENF1002V Series= ERJ-8E	Res= 10.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 19 mm ²
21.	RI	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 19 mm ²
22.	Rlc	Vishay-Dale	CRCW04024K53FKED Series= CRCW..e3	Res= 4.53 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 8 mm ²
23.	Rs	Vishay-Dale	CRCW0402121RFKED Series= CRCW..e3	Res= 121.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 8 mm ²
24.	Rt1	Vishay-Dale	CRCW04024M75FKED Series= CRCW..e3	Res= 4.75 MOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 8 mm ²
25.	Rt2	Vishay-Dale	CRCW04024M75FKED Series= CRCW..e3	Res= 4.75 MOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 8 mm ²
26.	Rt3	Vishay-Dale	CRCW04024M75FKED Series= CRCW..e3	Res= 4.75 MOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 8 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	T1	CUSTOM	CUSTOM	Lp= 414.504 μ H Rp= 424.002 mOhm Leakage_L= 8.29 μ H Ns1toNp= 0.073 Rs1= 12.751 mOhms Ns2toNp= 0.243 Rs2= 370.462 Ohms	1	NA	CUSTOM 0 mm ²
28.	U1	Texas Instruments	UCC28700DBVR	Switcher	1	\$0.35	 SOT-23-6 24 mm ²

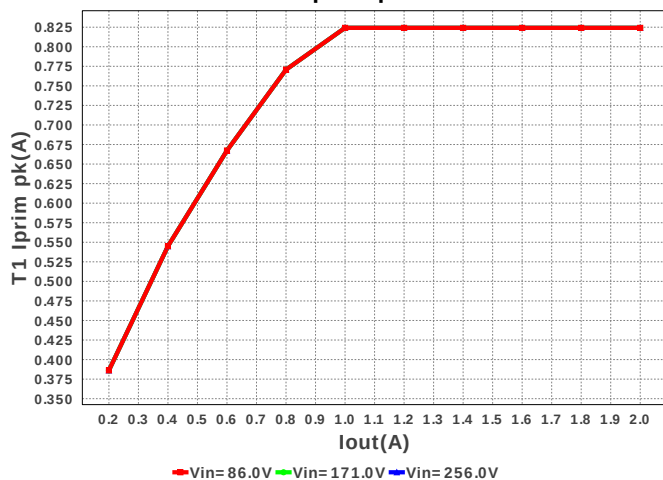
IC Tj



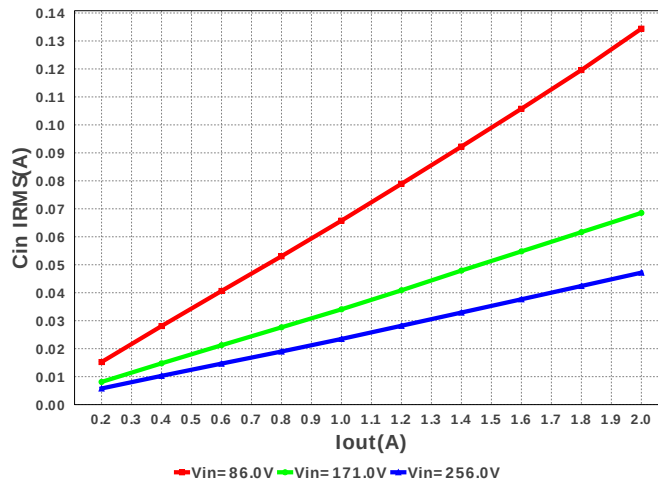
Duty Cycle

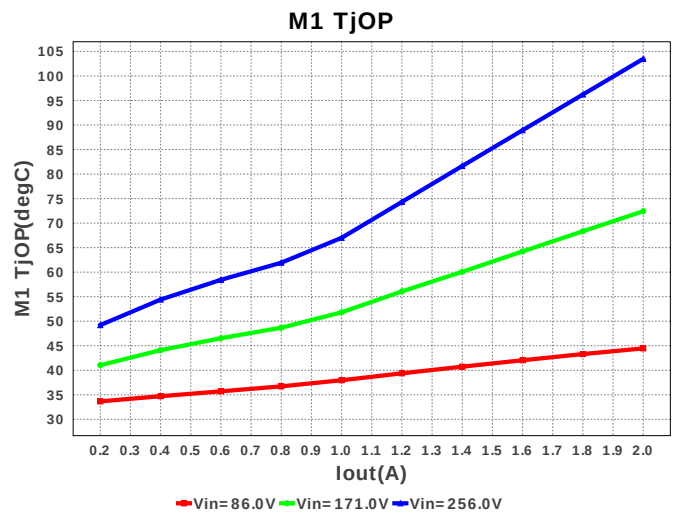
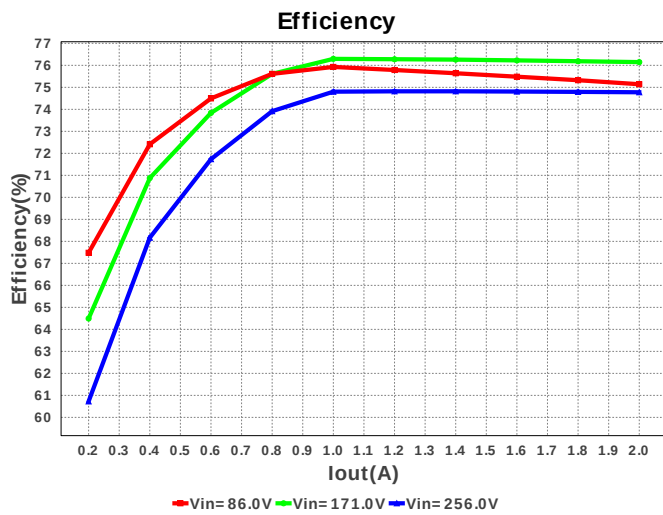
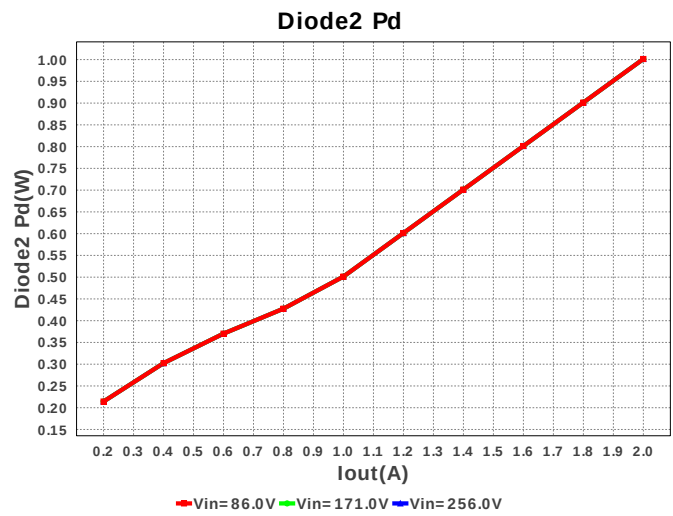
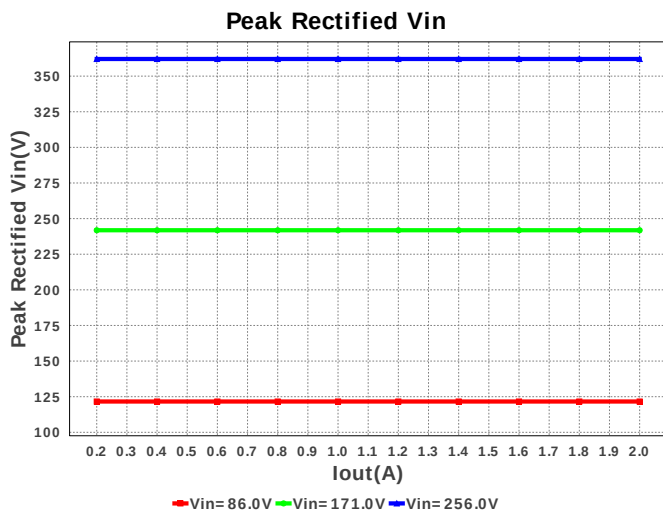
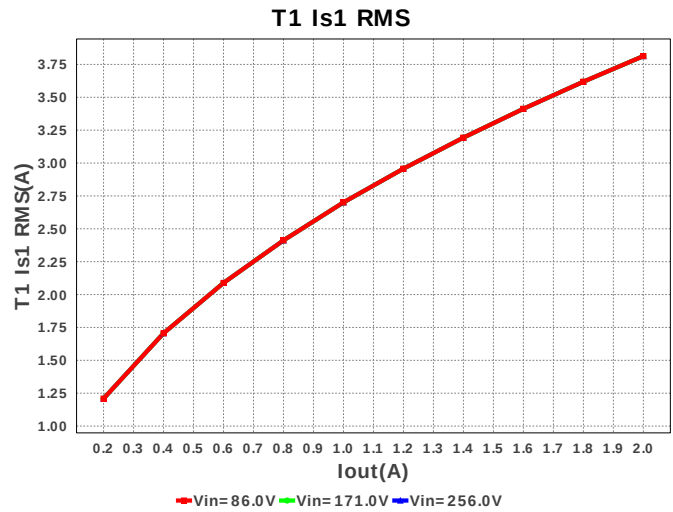
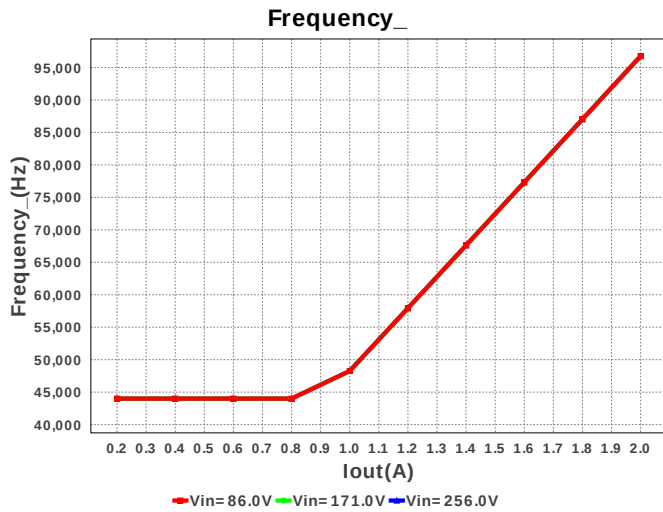


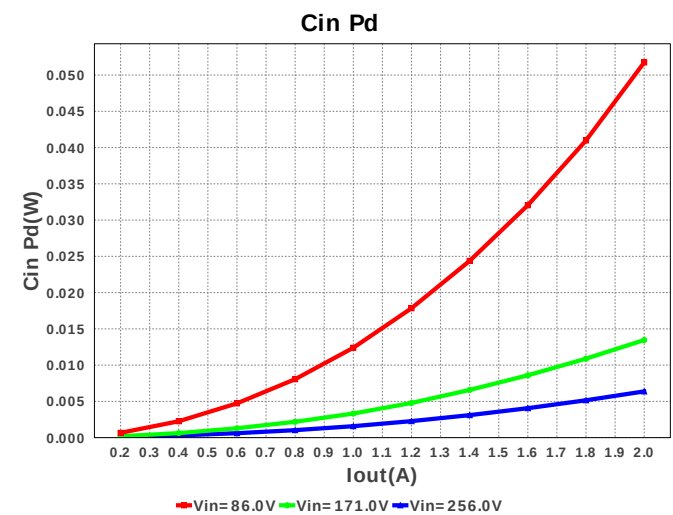
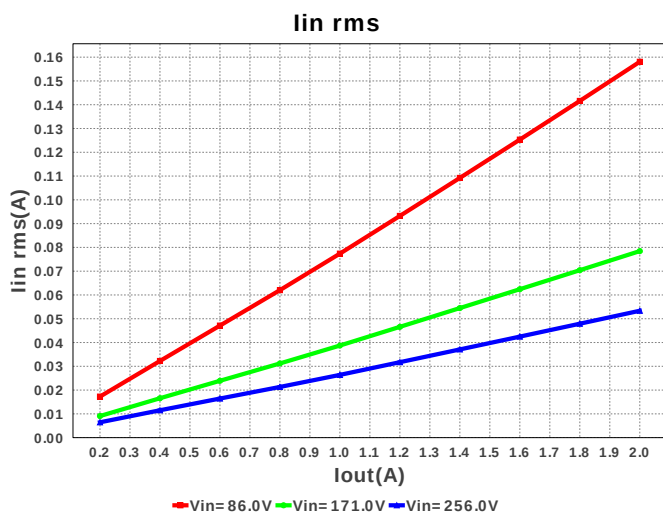
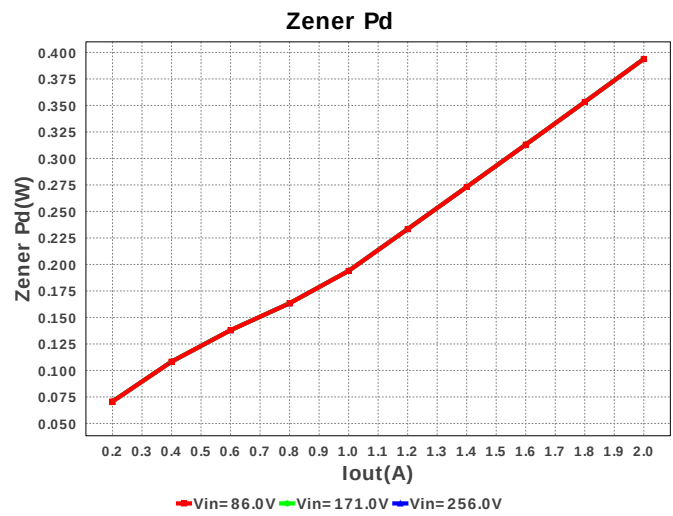
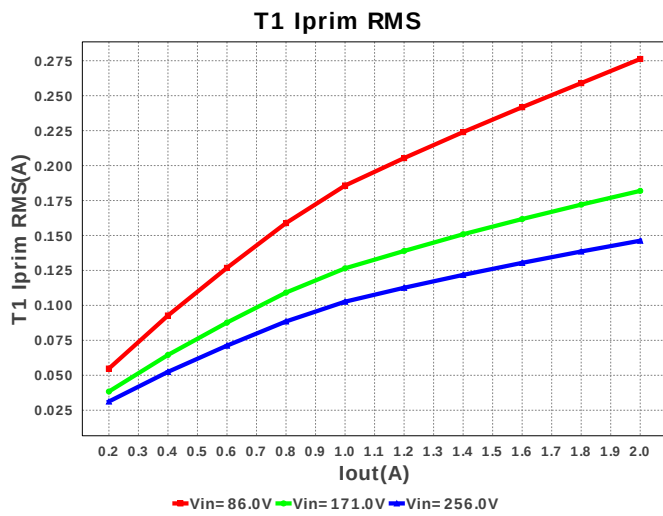
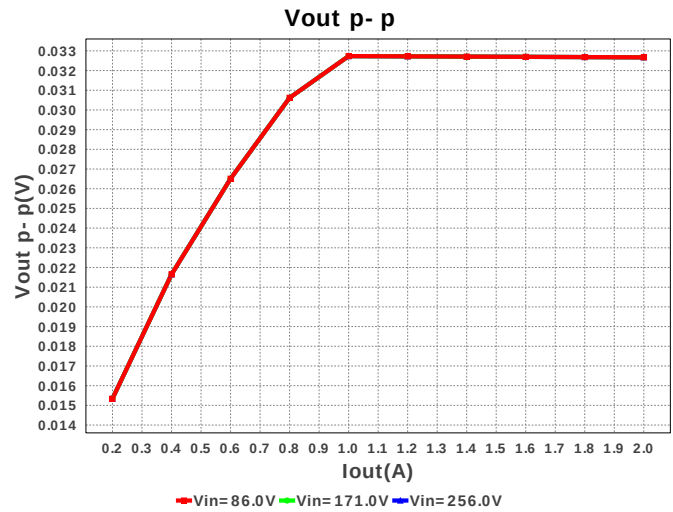
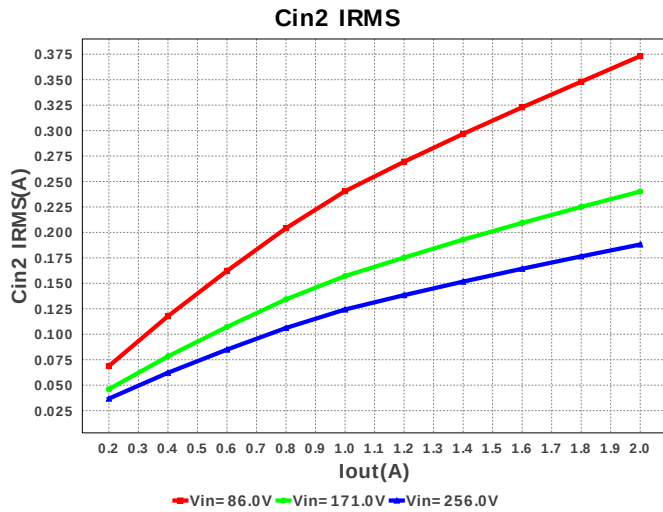
T1 Iprim pk

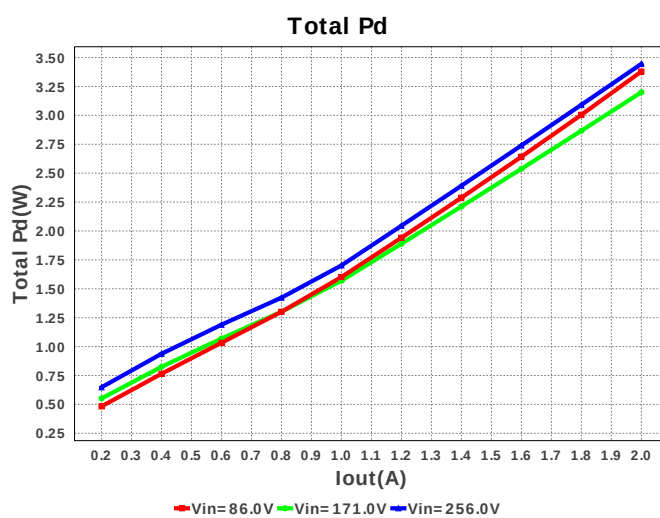
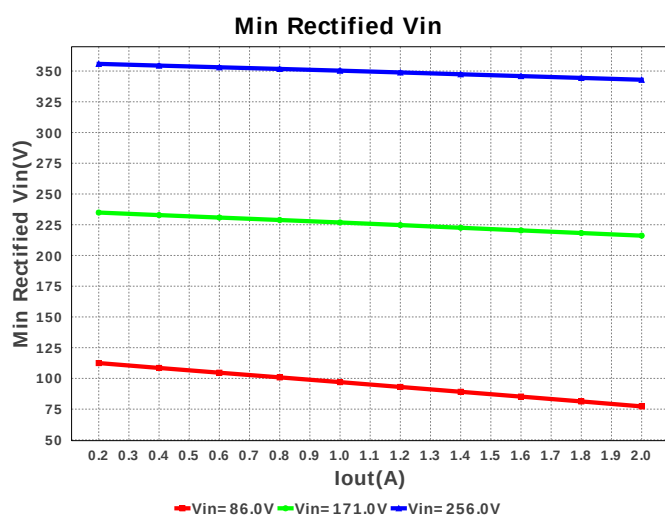
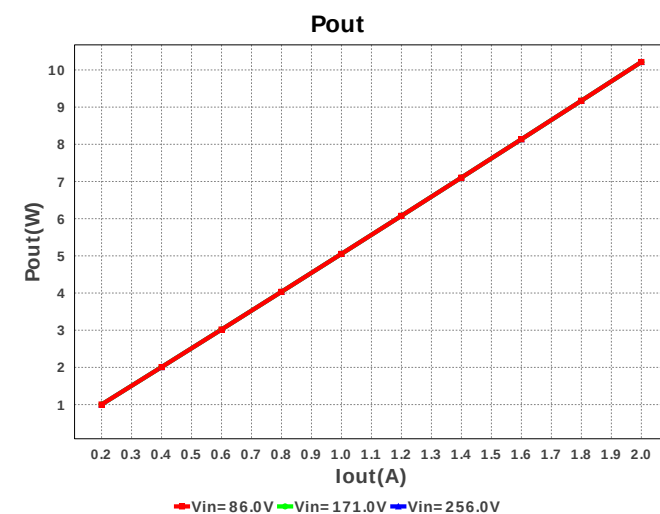
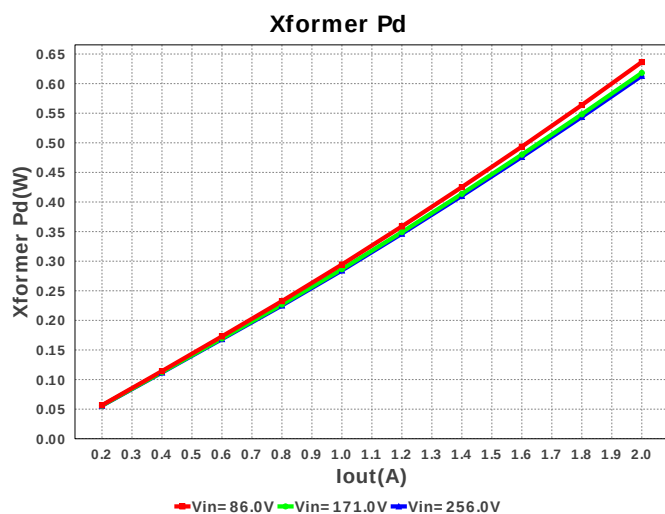
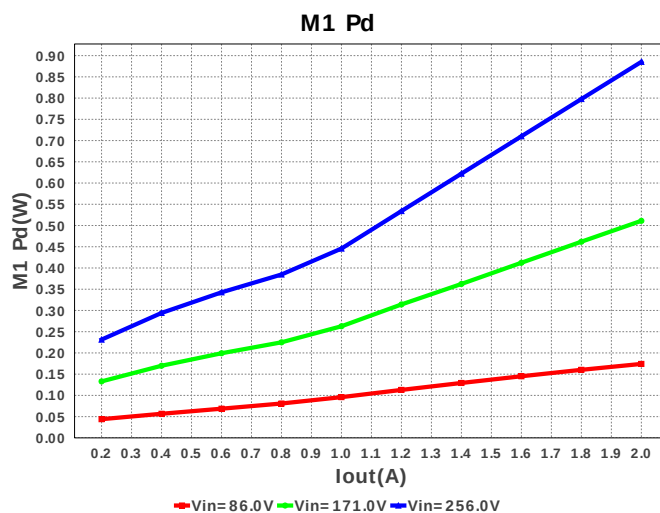
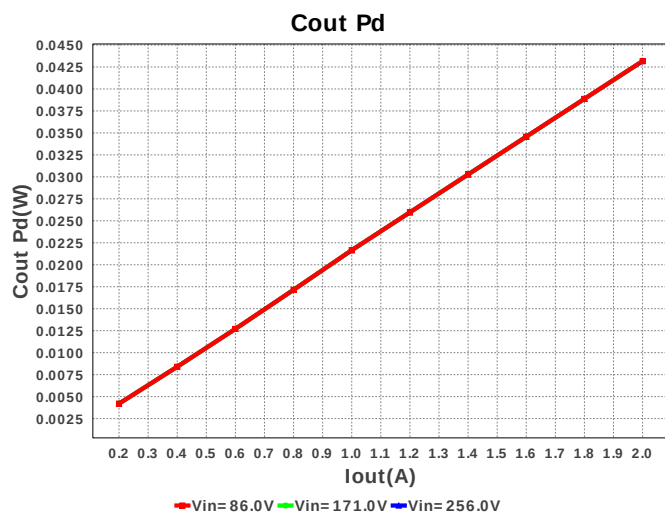


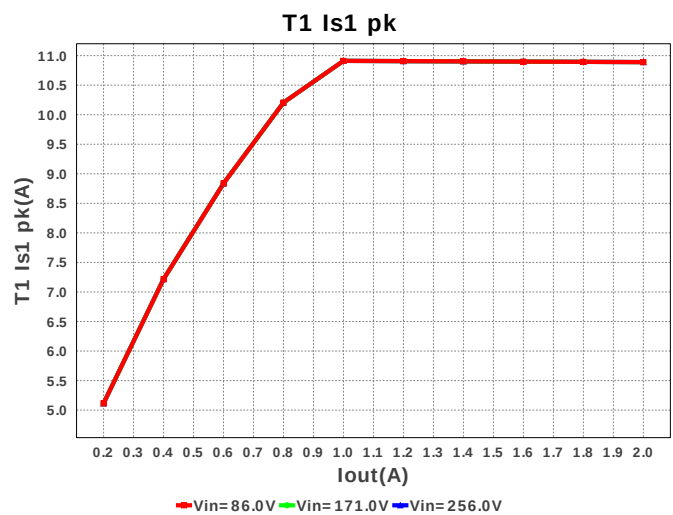
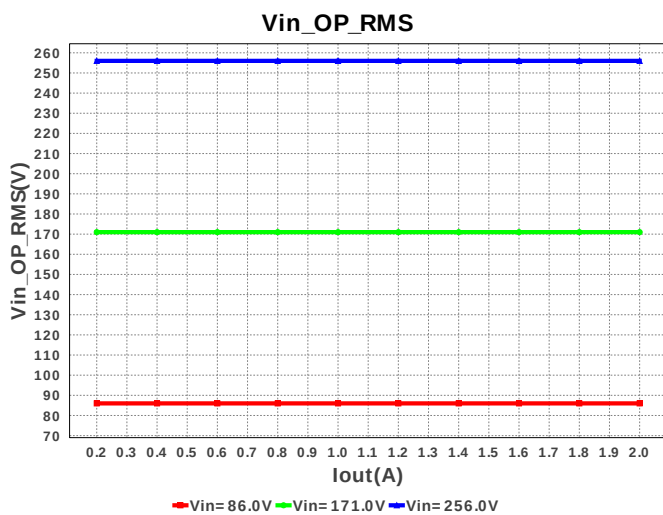
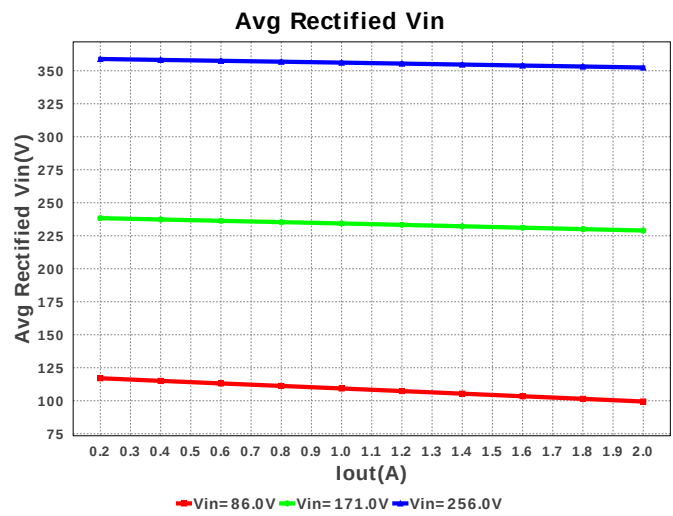
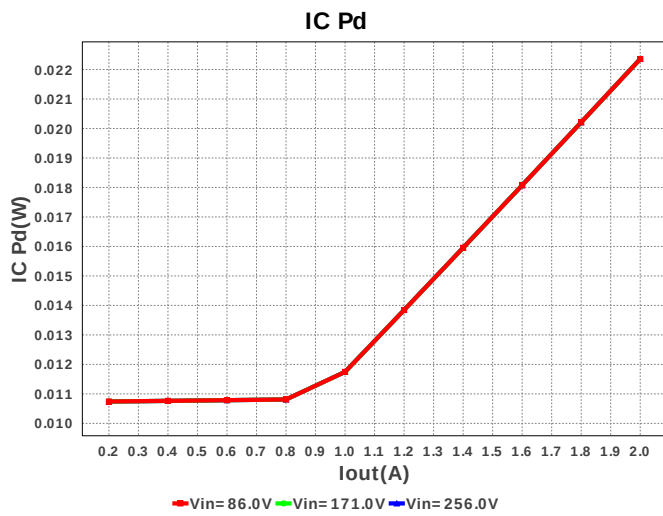
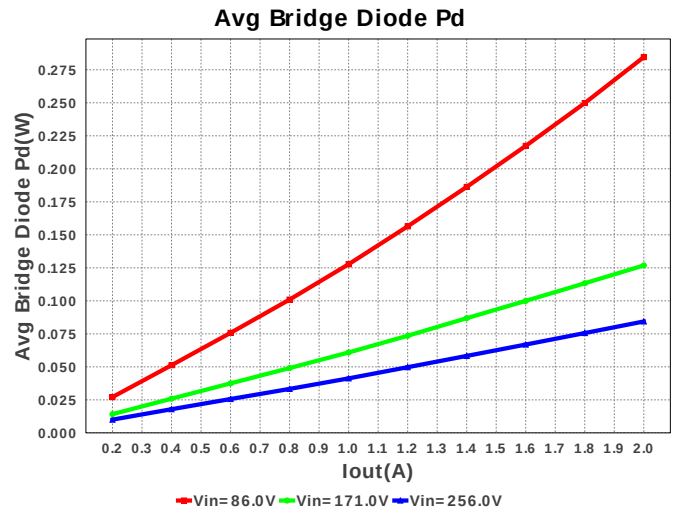
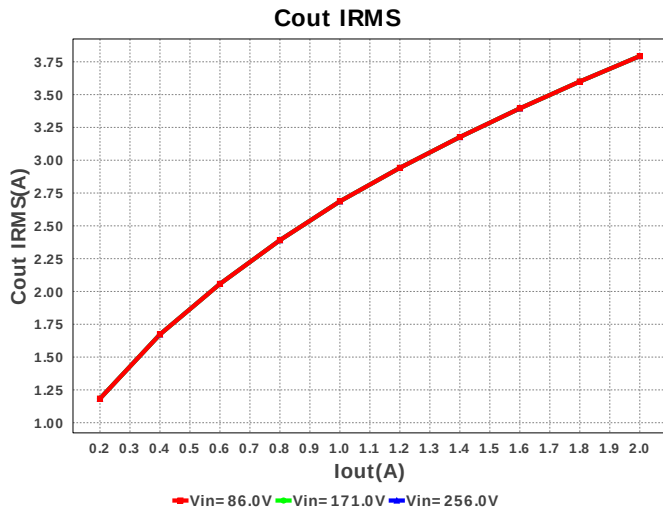
Cin IRMS

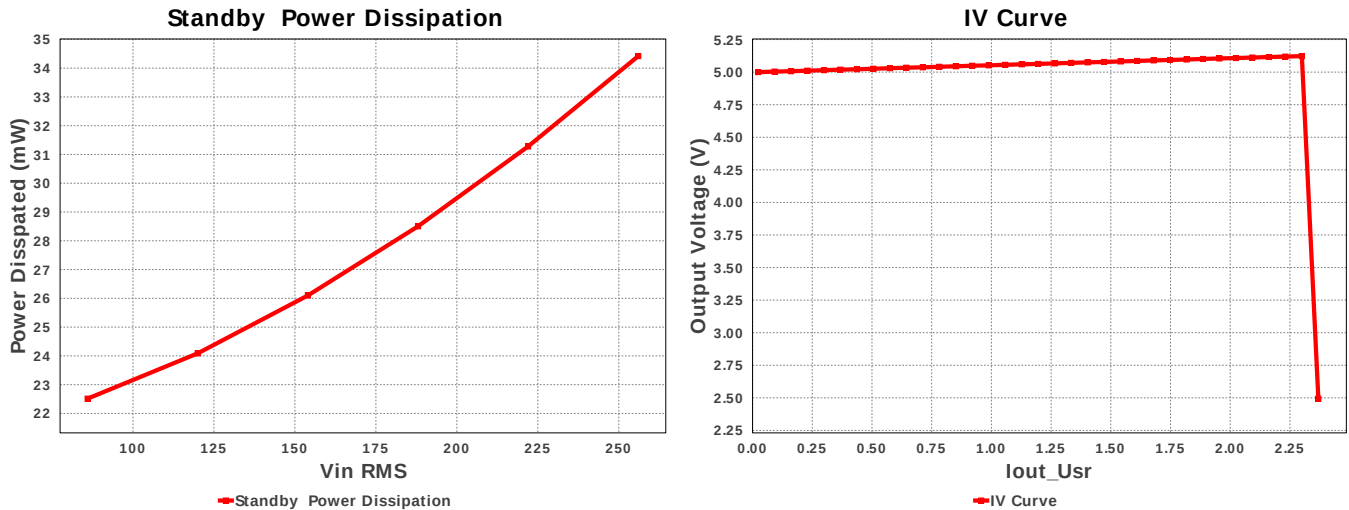












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	47.24 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	188.837 mA	Current	Input capacitor2 RMS ripple current
3.	Cout IRMS	3.793 A	Current	Output capacitor RMS ripple current
4.	Iin rms	53.383 mA	Current	RMS Input Current
5.	T1 Iprim RMS	146.951 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	824.176 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	3.813 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	10.891 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	349.646 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	31	General	Total Design BOM count
11.	FootPrint	1.61 k mm ²	General	Total Foot Print Area of BOM components
12.	Pout	10.214 W	General	Total output power
13.	Total BOM	\$0.0	General	Total BOM Cost
14.	Vout OP	5.107 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	9.537 %	Op_point	Duty cycle
16.	Efficiency	74.739 %	Op_point	Steady state efficiency
17.	Frequency	96.757 kHz	Op_point	Switching frequency
18.	IC Tj	31.565 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	102.643 degC	Op_point	M1 MOSFET junction temperature
22.	Min Rectified Vin	337.256 V	Op_point	Minimum voltage seen at rectified input
23.	Peak Rectified Vin	362.035 V	Op_point	Peak voltage seen at rectified input
24.	Vin_OP_RMS	256.0 V	Op_point	AC Input RMS Voltage
25.	Vout p-p	32.672 mV	Op_point	Peak-to-peak output ripple voltage
26.	Avg Bridge Diode Pd	85.113 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
27.	Cin Pd	6.393 mW	Power	Input capacitor power dissipation
28.	Cout Pd	43.169 mW	Power	Output capacitor power dissipation
29.	Diode2 Pd	1.001 W	Power	Diode2 power dissipation
30.	IC Pd	22.357 mW	Power	IC power dissipation
31.	M1 Pd	875.217 mW	Power	M1 MOSFET total power dissipation
32.	Total Pd	3.452 W	Power	Total Power Dissipation
33.	Xformer Pd	613.271 mW	Power	Transformer power dissipation
34.	Zener Pd	393.838 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	256.0	Maximum input voltage
4.	VinMin	86.0	Minimum input voltage
5.	Vout	5.0	Output Voltage
6.	Vout1	5.0	Output Voltage #1
7.	base_pn	UCC28700	Base Product Number
8.	source	AC	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. Rfbd & Rfbb The feedback resistors will set the output voltage of the circuit. The values chosen may need to be fine 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.

Texas Instruments' WEBENCH simulation tools attempt to recreate the performance of a substantially equivalent physical implementation of the design. Simulations are created using Texas Instruments' published specifications as well as the published specifications of other device manufacturers. While Texas Instruments does update this information periodically, this information may not be current at the time the simulation is built. Texas Instruments does not warrant the accuracy or completeness of the specifications or any information contained therein. Texas Instruments does not warrant that any designs or recommended parts will meet the specifications you entered, will be suitable for your application or fit for any particular purpose, or will operate as shown in the simulation in a physical implementation. Texas Instruments does not warrant that the designs are production worthy.

You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.

Use of Texas Instruments' WEBENCH simulation tools is subject to [Texas Instruments' Site Terms and Conditions of Use](#). Prototype boards based on WEBENCH created designs are provided AS IS without warranty of any kind for evaluation and testing purposes and are subject to the terms of the [Evaluation License Agreement](#).