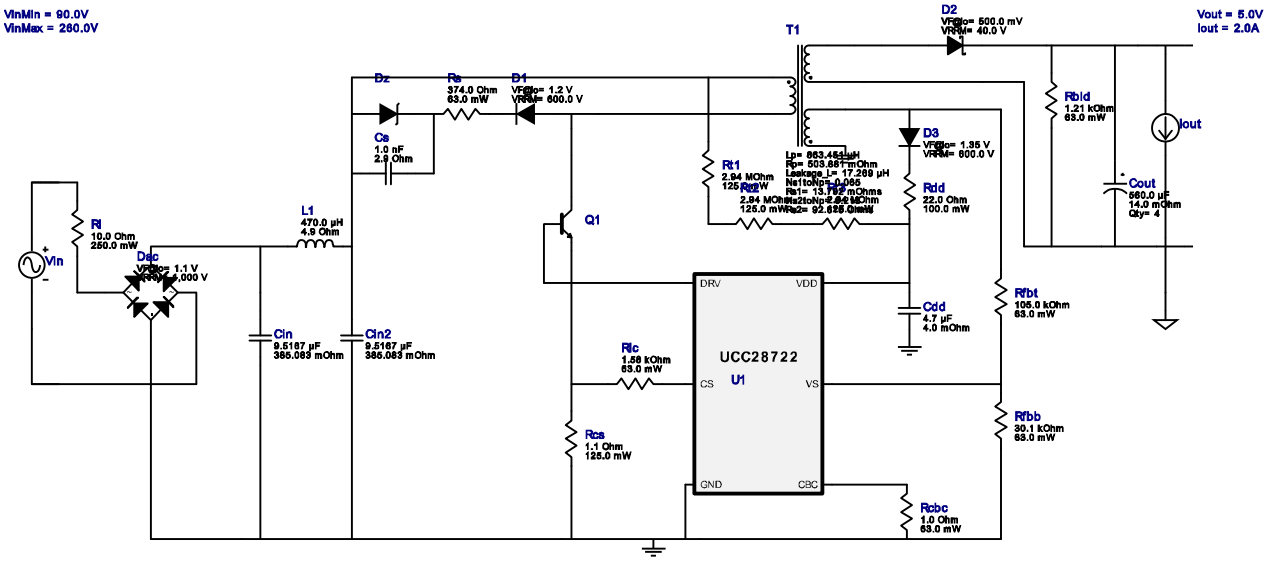
WEBENCH® Design Report

VinMin = 90.0V
VinMax = 260.0V
Vout = 5.0V
Iout = 2.0A

Device = UCC28722DBVR
Topology = Flyback
Created = 6/12/15 12:39:28 AM
BOM Cost = $0.00
Footprint = 982.0 mm²
BOM Count = 29
Total Pd = 3.41W

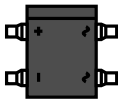
Design : 4396489/1 UCC28722DBVR
UCC28722DBVR 90.0V-260.0V to 5.39V @ 2.0A

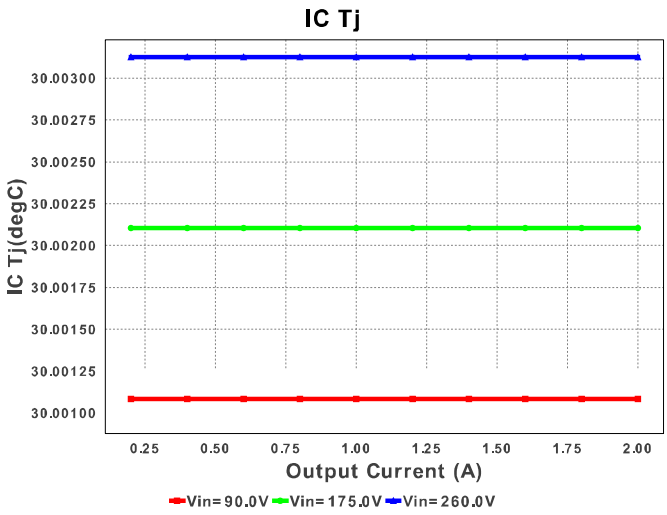


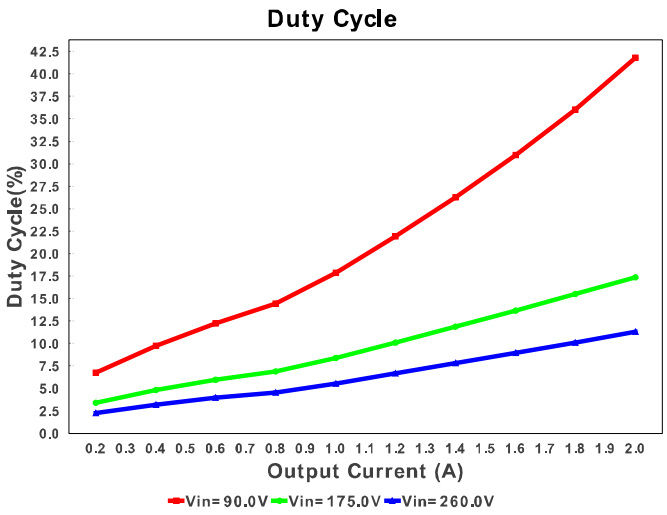
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

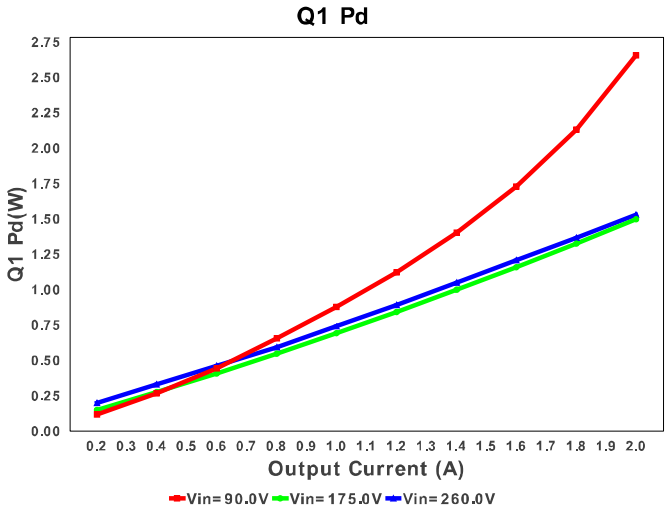
Electrical BOM

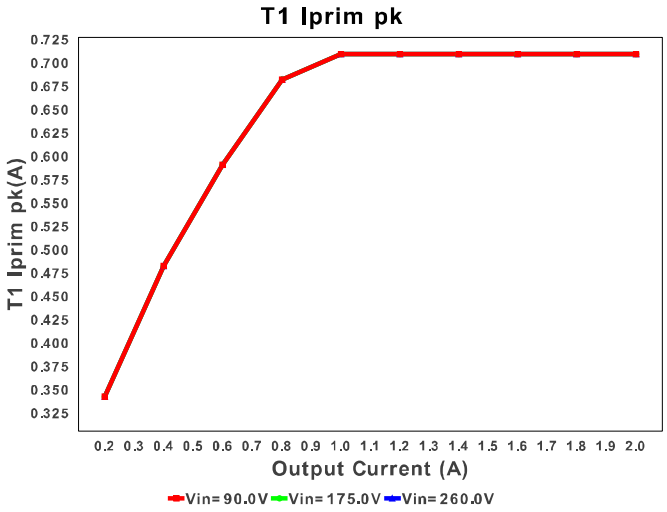
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 4.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm²
2.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 9.5167 uF ESR= 385.08 mOhm VDC= 551.54 V IRMS= 497.26 mA	1	NA	CUSTOM 0 mm²
3.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 9.5167 uF ESR= 385.08 mOhm VDC= 551.54 V IRMS= 497.26 mA	1	NA	CUSTOM 0 mm²
4.	Cout	Panasonic	16SVPF560M Series= 1273	Cap= 560.0 uF ESR= 14.0 mOhm VDC= 16.0 V IRMS= 4.95 A	4	$0.61	CAPSMT_62_E12 106 mm²
5.	Cs	MuRata	GRM188R72E102KW07D Series= X7R	Cap= 1.0 nF ESR= 2.9 Ohm VDC= 250.0 V IRMS= 90.0 mA	1	$0.02	0603 5 mm²
6.	D1	Bourns	CD214B-F3600	VF@Io= 1.2 V VRRM= 600.0 V	1	$0.14	SMB 44 mm²
7.	D2	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.11	SMA 37 mm²
8.	D3	Micro Commercial Components	ES1J-TP	VF@Io= 1.35 V VRRM= 600.0 V	1	$0.06	SMA 37 mm²

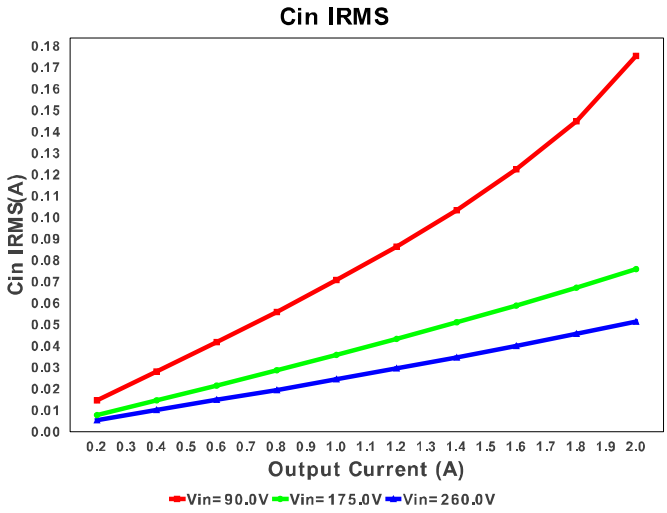
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	$0.24	 DF-S 99 mm²
10.	Dz	ON Semiconductor	MMBZ5270BLT1G	Zener	1	$0.03	 SOT-23 14 mm²
11.	L1	Bourns	SDR0503-471KL	L= 470.0 µH DCR= 4.9 Ohm	1	$0.19	 SDR0503 48 mm²
12.	Q1	STMicroelectronics	STN2580	Bipolar Transistor	1	$0.18	 SOT-223 76 mm²
13.	Rbld	Vishay-Dale	CRCW04021K21FKED Series= CRCW..e3	Res= 1.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
14.	Rcbc	Vishay-Dale	CRCW04021R00FKED Series= CRCW..e3	Res= 1.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
15.	Rcs	Vishay-Dale	CRCW08051R10FKEA Series= CRCW..e3	Res= 1.1 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
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 7 mm²
17.	Rfbb	Vishay-Dale	CRCW040230K1FKED Series= CRCW..e3	Res= 30.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
18.	Rfbt	Vishay-Dale	CRCW0402105KFKED Series= CRCW..e3	Res= 105.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
19.	Rl	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm²
20.	Rlc	Vishay-Dale	CRCW04021K58FKED Series= CRCW..e3	Res= 1.58 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Rs	Vishay-Dale	CRCW0402374RFKED Series= CRCW..e3	Res= 374.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
22.	Rt1	Vishay-Dale	CRCW08052M94FKEA Series= CRCW..e3	Res= 2.94 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
23.	Rt2	Vishay-Dale	CRCW08052M94FKEA Series= CRCW..e3	Res= 2.94 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
24.	Rt3	Vishay-Dale	CRCW08052M94FKEA Series= CRCW..e3	Res= 2.94 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
25.	T1	CUSTOM	CUSTOM	Lp= 863.451 µH Rp= 503.881 mOhm Leakage_L= 17.269 µH Ns1toNp= 0.065 Rs1= 13.792 mOhms Ns2toNp= 0.213 Rs2= 92.615 Ohms	1	NA	CUSTOM 0 mm²
26.	U1	Texas Instruments	UCC28722DBVR	Switcher	1	$0.25	 R-PDSO-G7 55 mm²

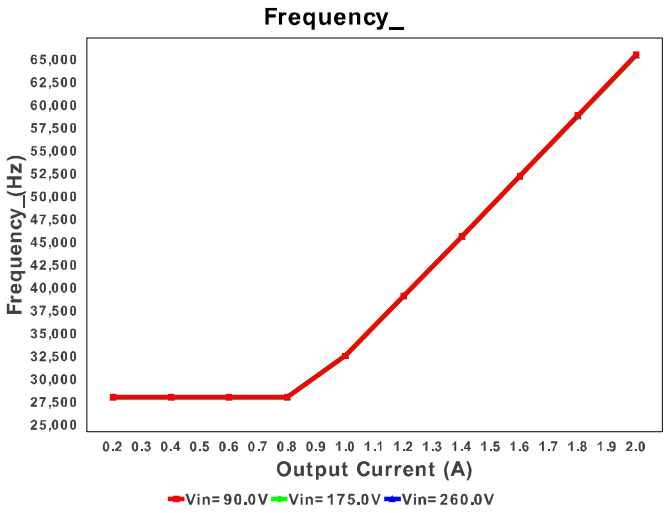


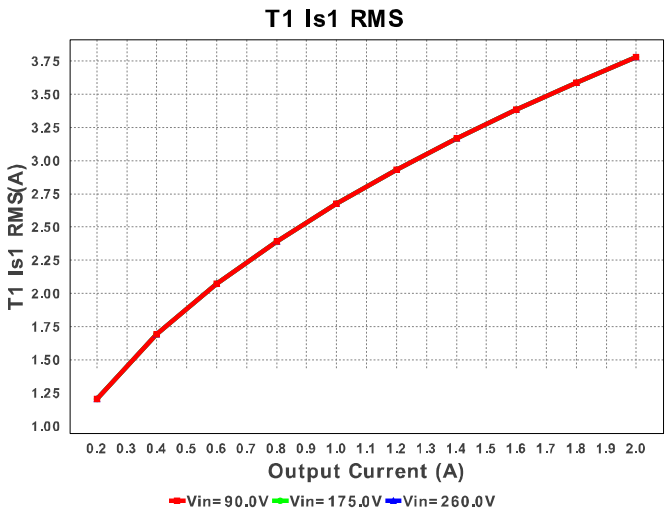


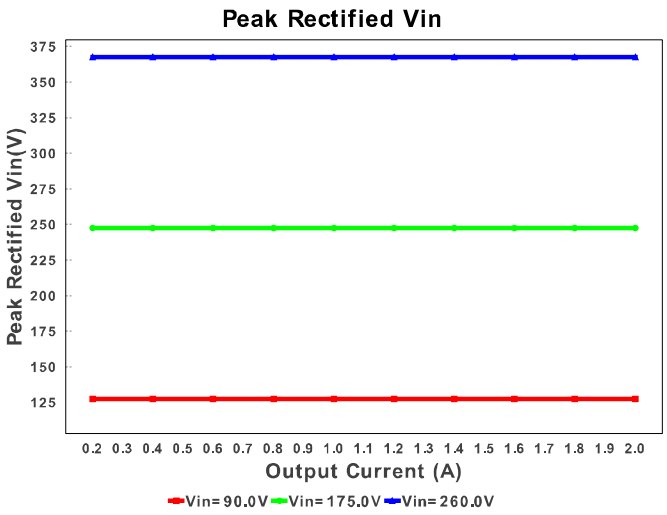


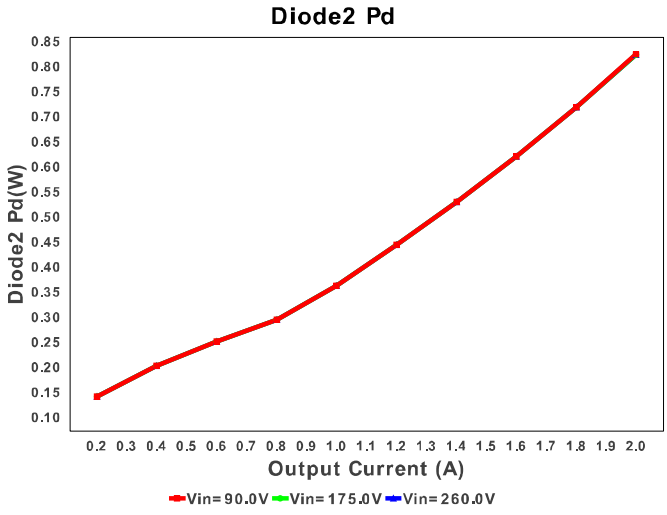


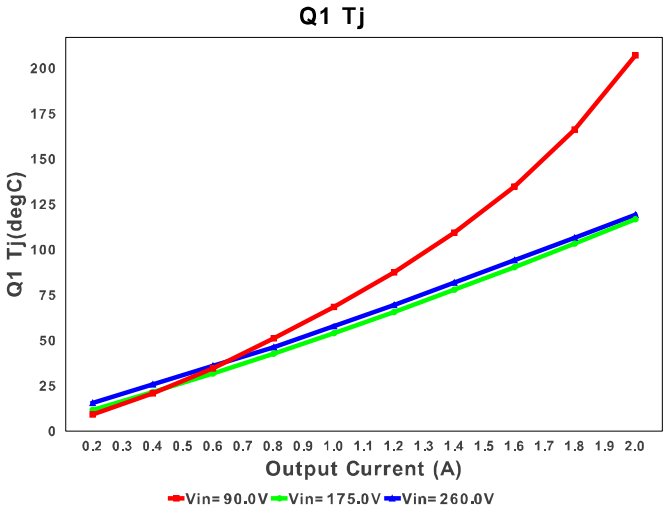


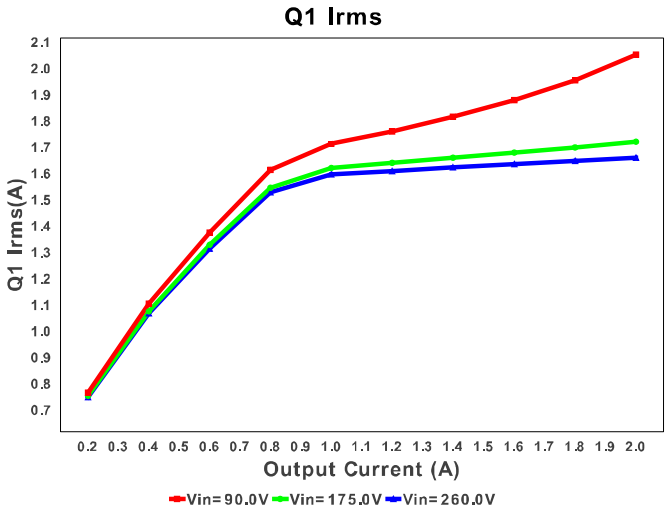


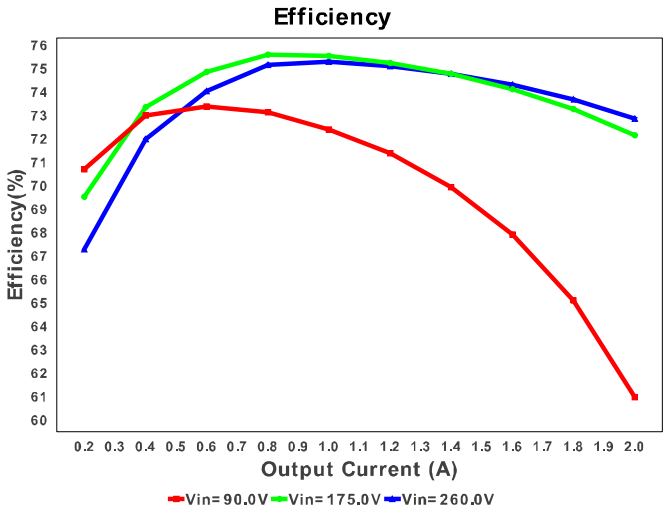


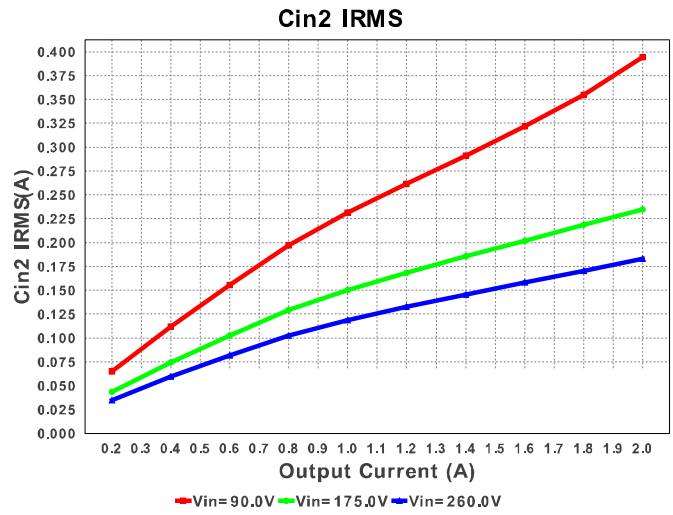


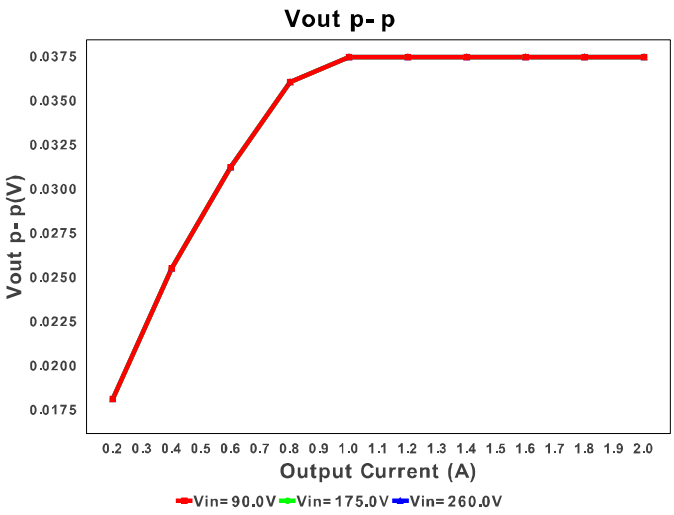


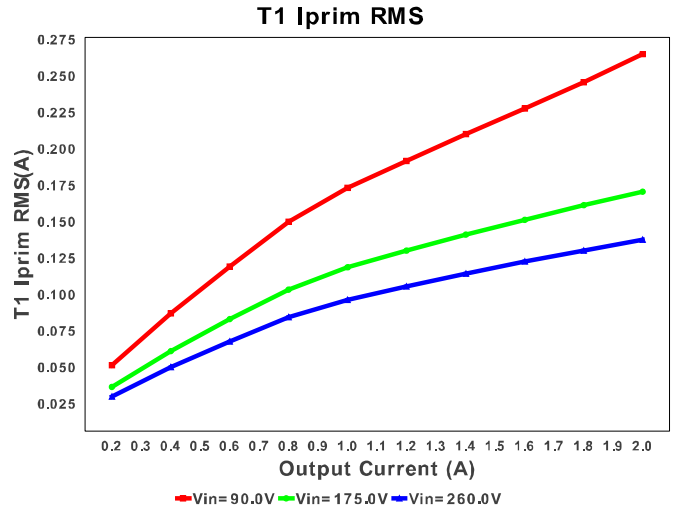


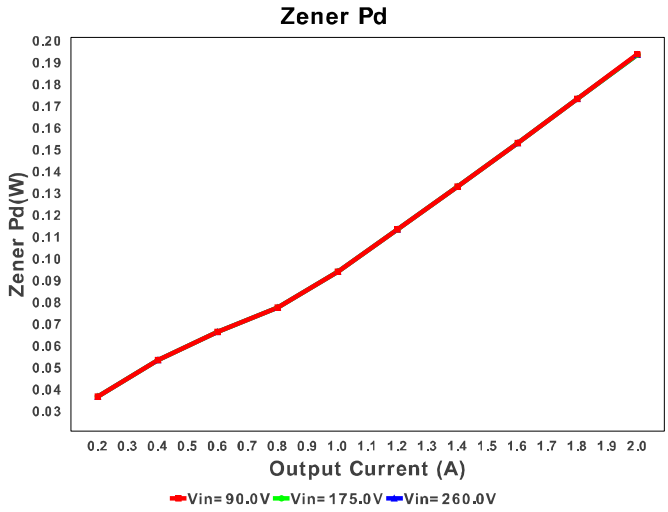


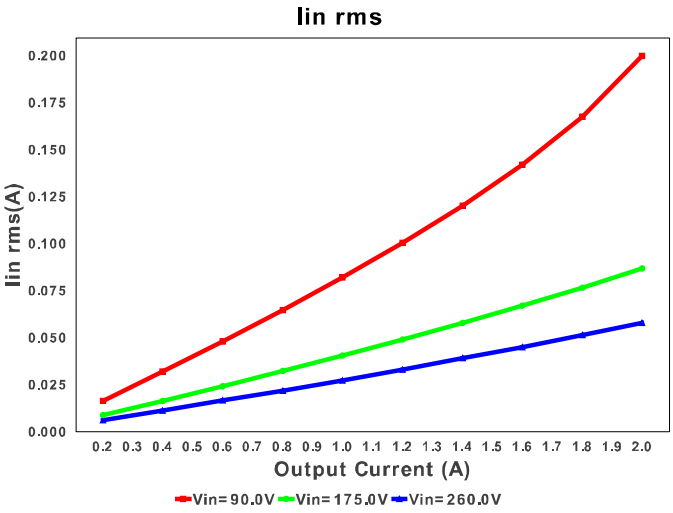


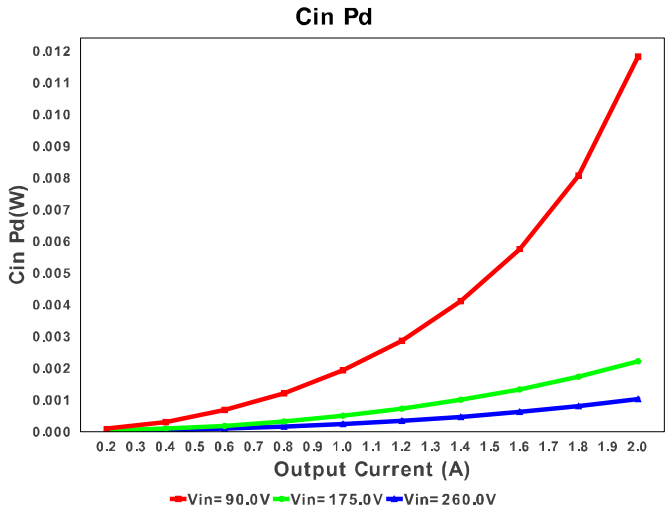


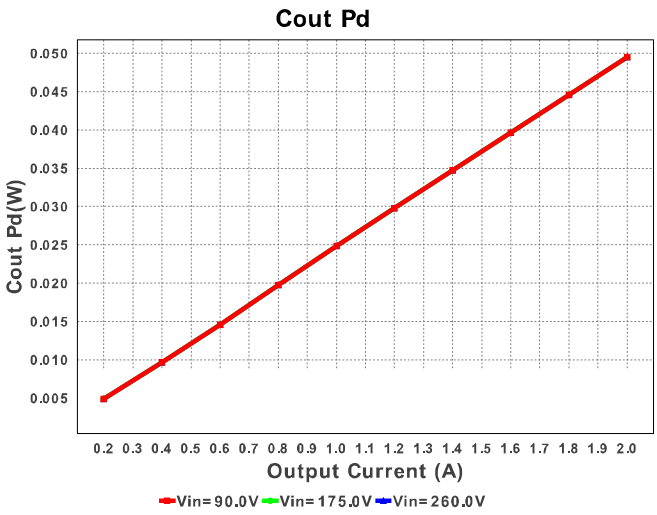


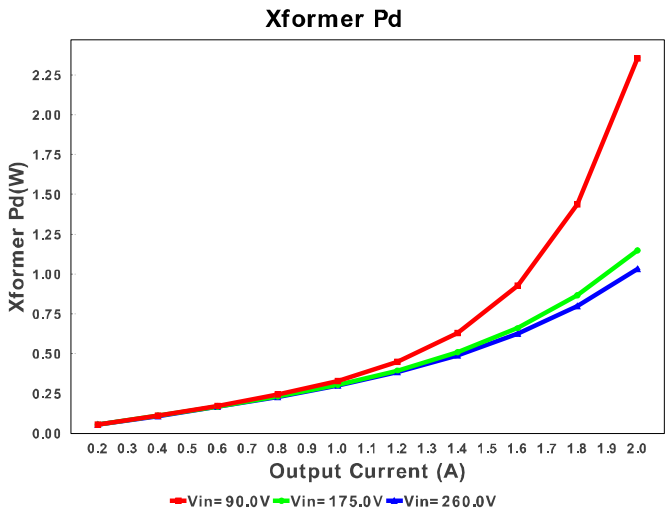


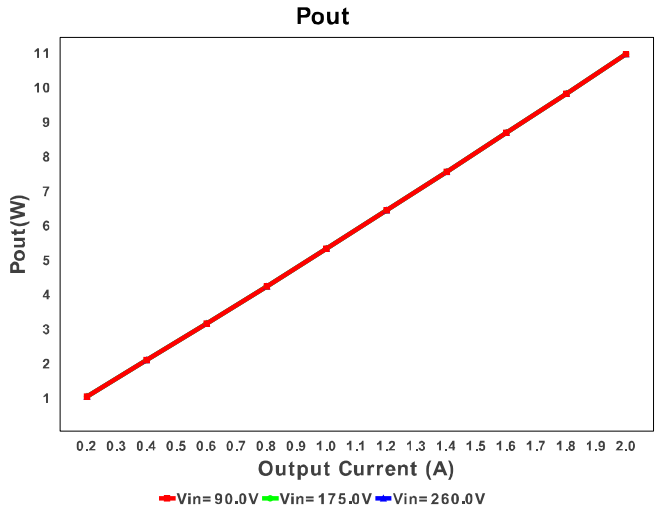


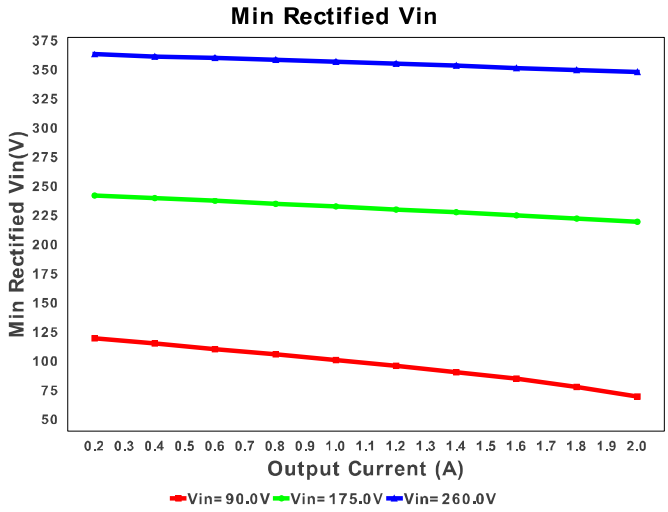


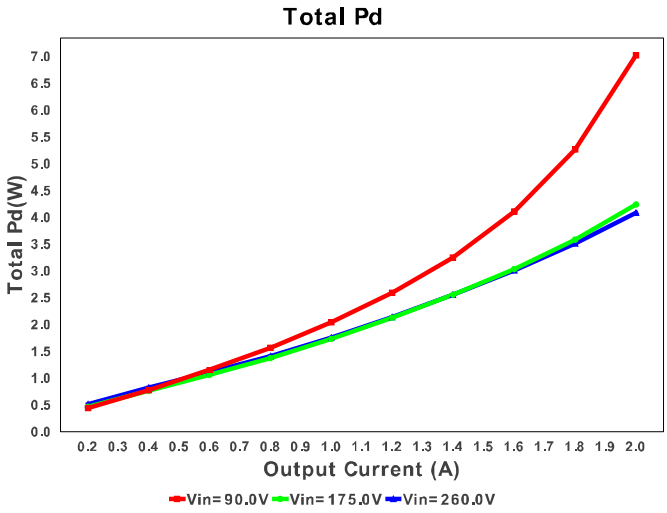


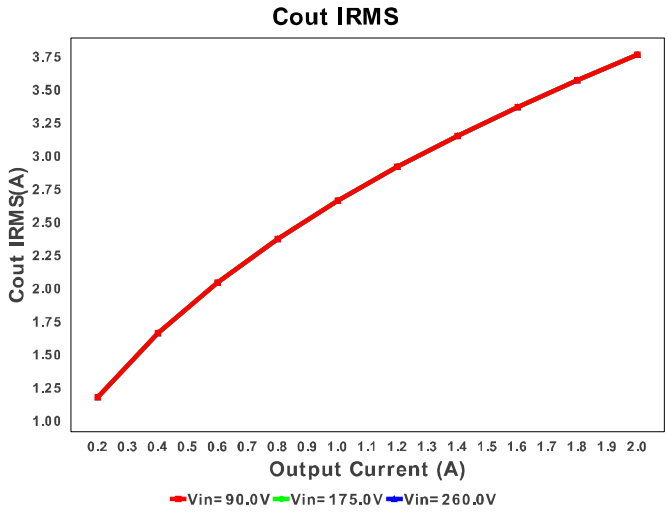


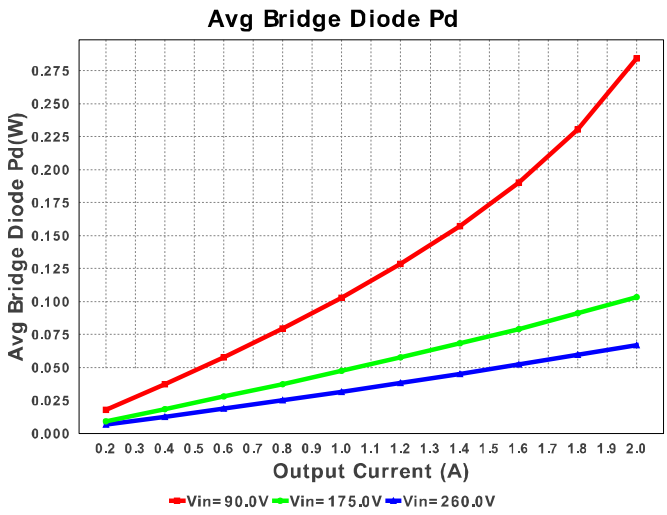


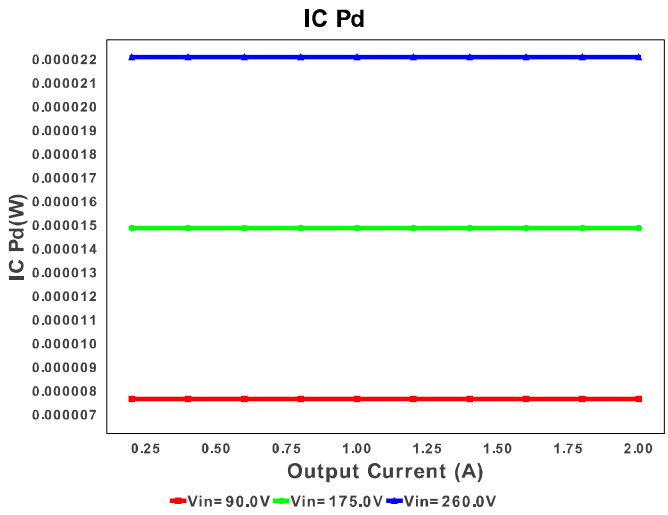


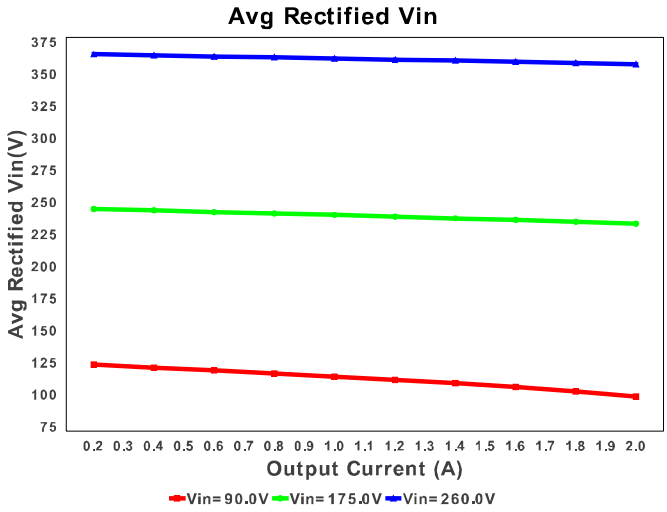


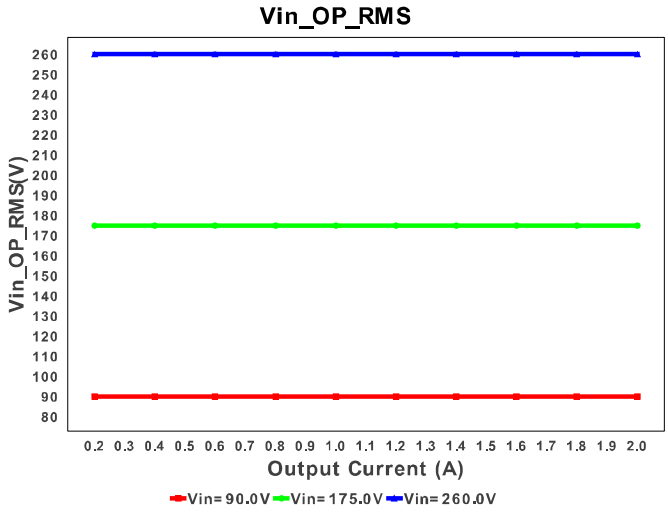


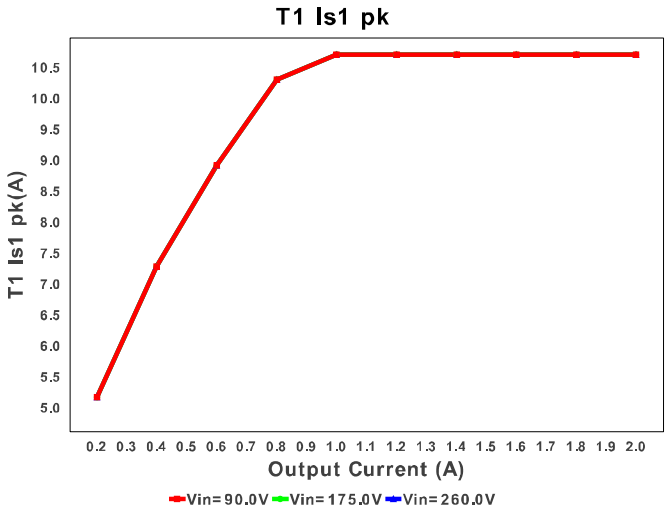


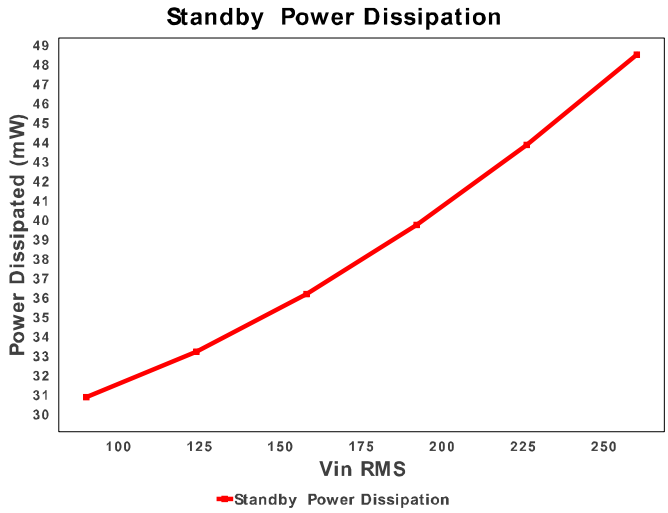


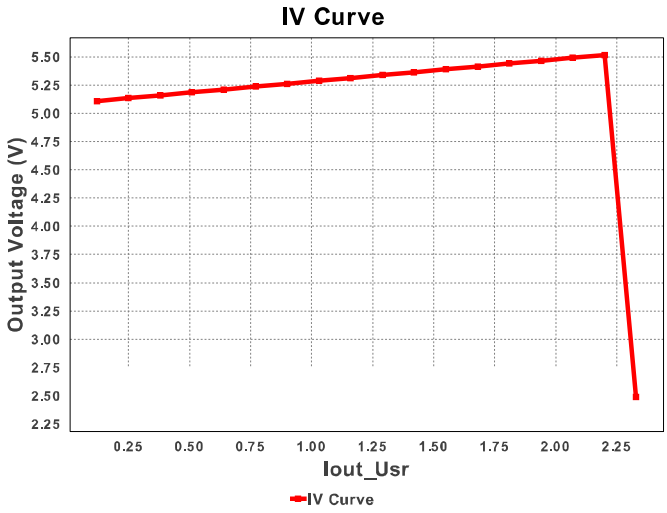












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	48.592 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	181.78 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	3.762 A	Current	Output capacitor RMS ripple current
4.	Iin rms	54.571 mA	Current	RMS Input Current
5.	Q1 Irms	1.64 A	Current	Q1 RMS current
6.	T1 Iprim RMS	139.385 mA	Current	Transformer Primary RMS Current
7.	T1 Iprim pk	709.091 mA	Current	Transformer Primary Peak Current
8.	T1 Is1 RMS	3.782 A	Current	Transformer Secondary1 RMS Current
9.	T1 Is1 pk	10.702 A	Current	Transformer Secondary1 Peak Current
10.	Avg Rectified Vin	355.19 V	General	Average Rectified Voltage for the AC Line Period
11.	BOM Count	29	General	Total Design BOM count
12.	FootPrint	982.0 mm^2	General	Total Foot Print Area of BOM components
13.	Pout	10.778 W	General	Total output power
14.	Total BOM	$0.0	General	Total BOM Cost
15.	Q1 Tj	83.635 degC	Op_Point	Q1 Junction Temperature
16.	Vout OP	5.389 V	Op_Point	Operational Output Voltage
17.	Duty Cycle	11.592 %	Op_point	Duty cycle
18.	Efficiency	75.963 %	Op_point	Steady state efficiency
19.	Frequency	66.425 kHz	Op_point	Switching frequency
20.	IC Tj	30.001 degC	Op_point	IC junction temperature
21.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
22.	IOUT_OP	2.0 A	Op_point	Iout operating point
23.	Min Rectified Vin	342.687 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	37.456 mV	Op_point	Peak-to-peak output ripple voltage
27.	Avg Bridge Diode Pd	57.928 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
28.	Cin Pd	909.248 µW	Power	Input capacitor power dissipation
29.	Cout Pd	49.522 mW	Power	Output capacitor power dissipation
30.	Diode2 Pd	1.002 W	Power	Diode2 power dissipation
31.	IC Pd	7.65 µW	Power	IC power dissipation
32.	Q1 Pd	1.072 W	Power	Q1 Power Dissipation
33.	Total Pd	3.41 W	Power	Total Power Dissipation
34.	Xformer Pd	650.638 mW	Power	Transformer power dissipation
35.	Zener Pd	196.532 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	5.0	Output Voltage
6.	Vout1	5.0	Output Voltage #1
7.	base_pn	UCC28722	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. Rcbc Rcbc is used to set the amount of output voltage compensation to offset cable resistance. Connecting this resistor from the CBC pin to GND will program a current that is summed into the VS feedback divider, increasing the regulation voltage as Iout increases. Rcbc may be left unpopulated if voltage compensation is not required. 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. Clamping Diode at VDD pin Dependng on the startup resistor, an additional zener diode connected to the VDD pin may be required at light load and high line conditions. This is to prevent the voltage at VDD from running away since the IC would not consume all the current that passes through the startup resistor. 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/ucc28722.pdf

2. **UCC28722** Product Folder : http://www.ti.com/product/UCC28722 : contains the data sheet and other resources.