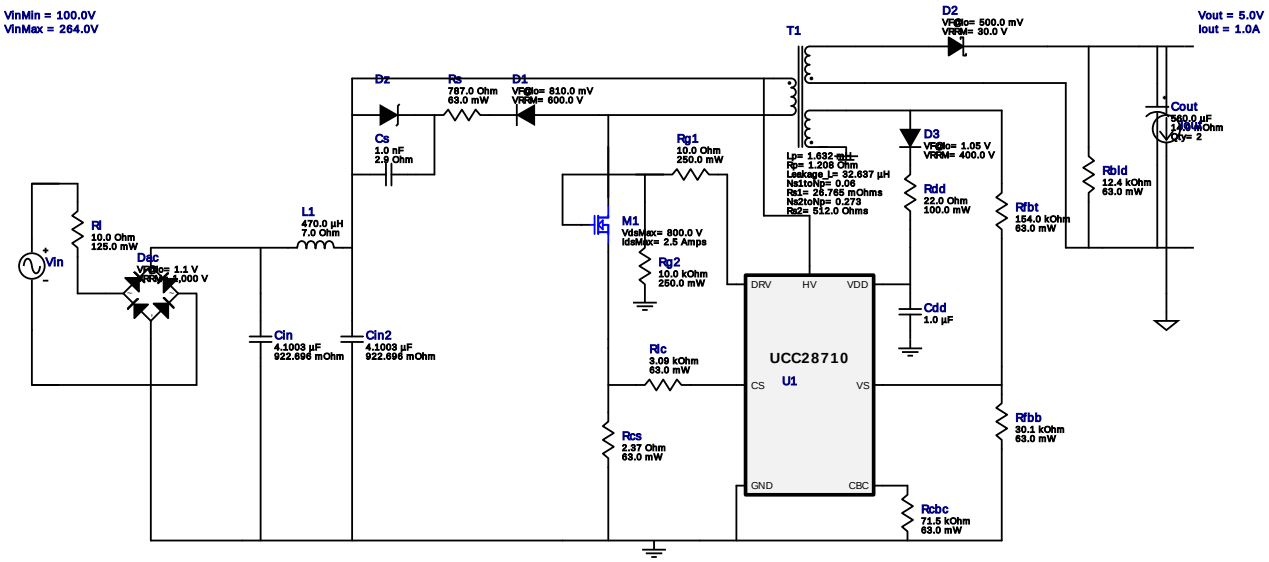
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 100.0V
VinMax = 264.0V
Vout = 5.0V
Iout = 1.0A

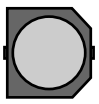
Device = UCC28710DR
Topology = Flyback
Created = 6/2/15 2:32:50 AM
BOM Cost = $0.00
Footprint = 751.0 mm^2
BOM Count = 26
Total Pd = 1.29W

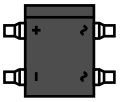
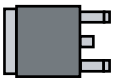
Design : 4057337/1 UCC28710DR
UCC28710DR 100.0V-264.0V to 5.54V @ 1.0A

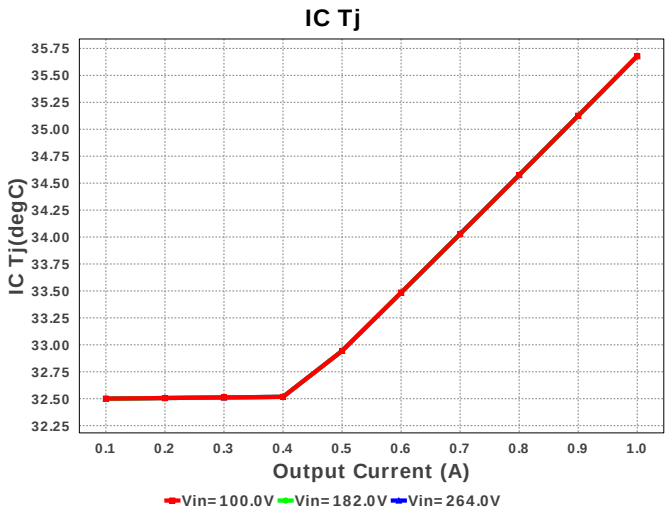


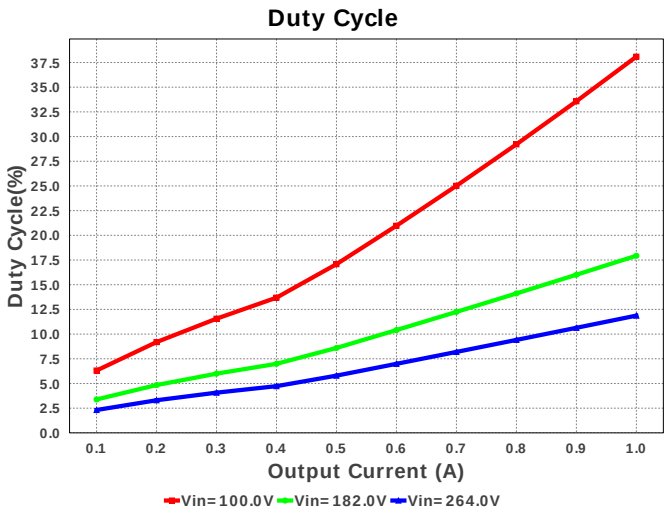
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

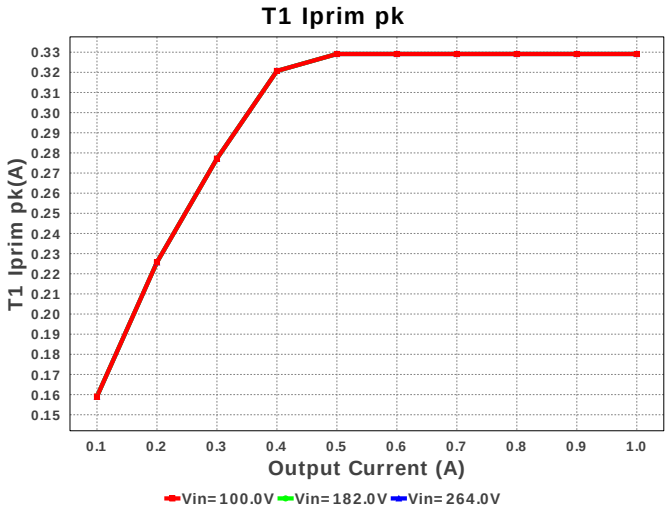
Electrical BOM

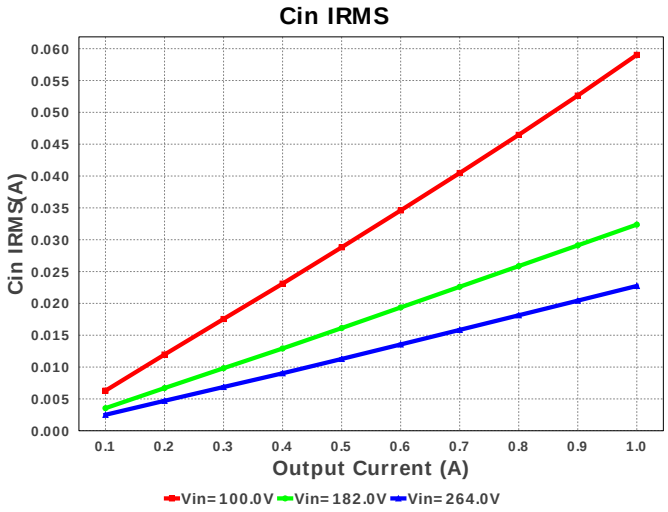
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	 0603 5 mm^2
2.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 4.1003 uF ESR= 922.7 mOhm VDC= 560.02 V IRMS= 227.154 mA	1	NA	CUSTOM 0 mm^2
3.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 4.1003 uF ESR= 922.7 mOhm VDC= 560.02 V IRMS= 227.154 mA	1	NA	CUSTOM 0 mm^2
4.	Cout	Panasonic	16SVPF560M Series= 1273	Cap= 560.0 uF ESR= 14.0 mOhm VDC= 16.0 V IRMS= 4.95 A	2	$0.61	 CAPSMT_62_E12 106 mm^2
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 mm^2
6.	D1	ON Semiconductor	MURS360T3	VF@Io= 810.0 mV VRRM= 600.0 V	1	$0.24	 SMC 83 mm^2
7.	D2	Diodes Inc.	B230A-13-F	VF@Io= 500.0 mV VRRM= 30.0 V	1	$0.09	 SMA 37 mm^2
8.	D3	Bourns	CD1408-FU1400	VF@Io= 1.05 V VRRM= 400.0 V	1	$0.13	 Diode_1408 13 mm^2

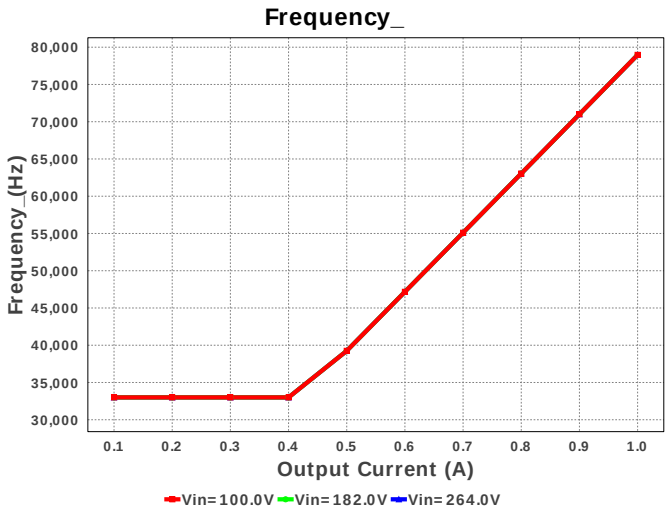
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	$0.24	 DF-S 99 mm²
10.	Dz	ON Semiconductor	MMBZ5270BLT1G	Zener	1	$0.03	 SOT-23 14 mm²
11.	L1	Bourns	SDR0403-471KL	L= 470.0 µH DCR= 7.0 Ohm	1	$0.18	 SDR0403 28 mm²
12.	M1	STMicroelectronics	STD3NK80ZT4	VdsMax= 800.0 V IdsMax= 2.5 Amps	1	$0.46	 DPAK 102 mm²
13.	Rbld	Vishay-Dale	CRCW040212K4FKED Series= CRCW..e3	Res= 12.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
14.	Rcbc	Vishay-Dale	CRCW040271K5FKED Series= CRCW..e3	Res= 71.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
15.	Rcs	Vishay-Dale	CRCW04022R37FKED Series= CRCW..e3	Res= 2.37 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 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	CRCW0402154KFKED Series= CRCW..e3	Res= 154.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
19.	Rg1	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm²
20.	Rg2	Panasonic	ERJ-8ENF1002V Series= ERJ-8E	Res= 10.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm²
21.	Rl	Vishay-Dale	CRCW080510R0FKEA Series= CRCW..e3	Res= 10.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
22.	Rlc	Vishay-Dale	CRCW04023K09FKED Series= CRCW..e3	Res= 3.09 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
23.	Rs	Vishay-Dale	CRCW0402787RFKED Series= CRCW..e3	Res= 787.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
24.	T1	CUSTOM	CUSTOM	Lp= 1.632 mH Rp= 1.208 Ohm Leakage_L= 32.637 µH Ns1toNp= 0.06 Rs1= 26.765 mOhms Ns2toNp= 0.273 Rs2= 512.0 Ohms	1	NA	CUSTOM 0 mm²
25.	U1	Texas Instruments	UCC28710DR	Switcher	1	$0.42	 SOIC-7 0 mm²

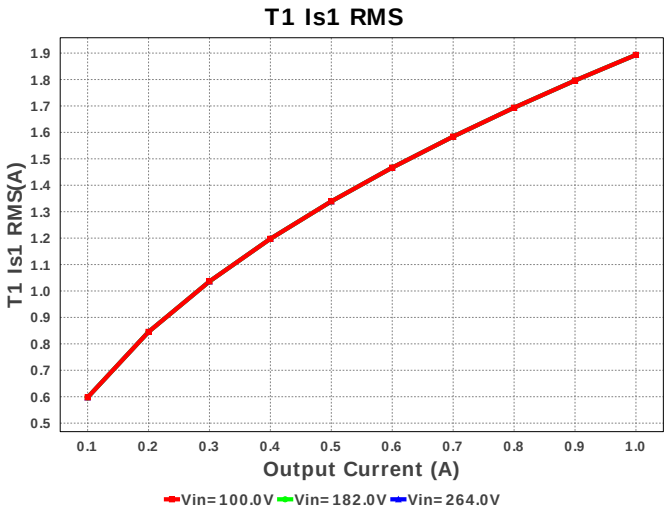


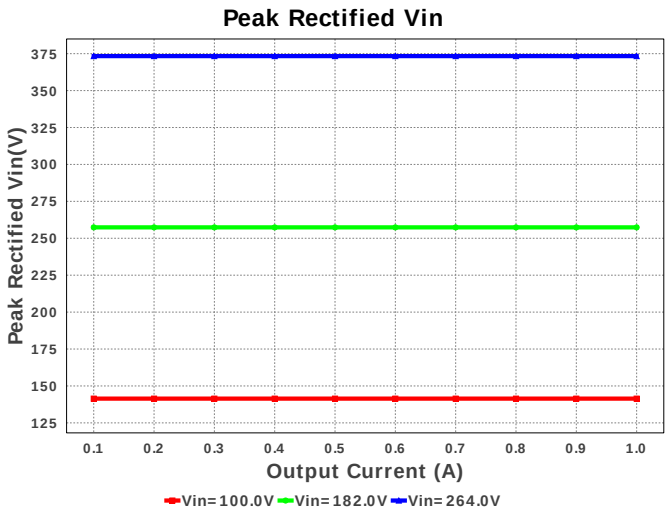


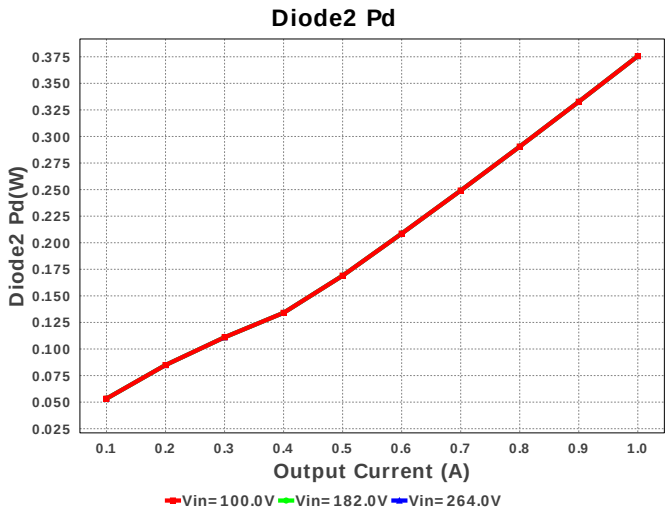


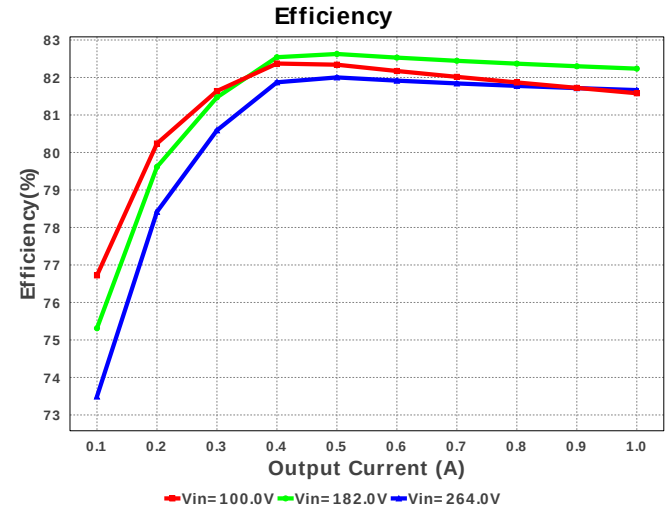


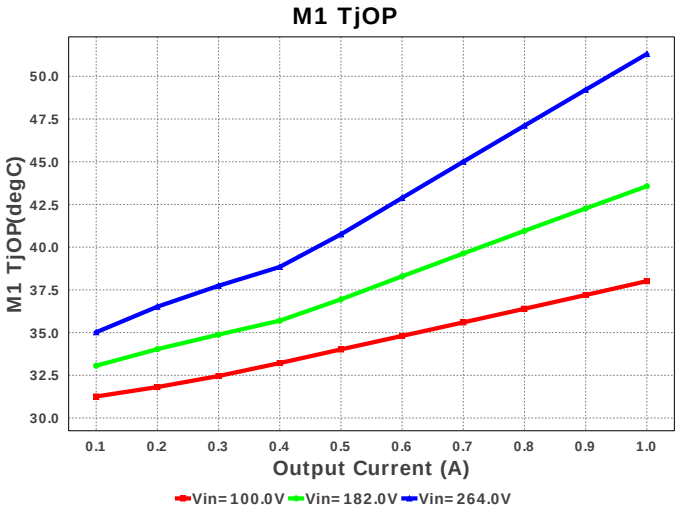


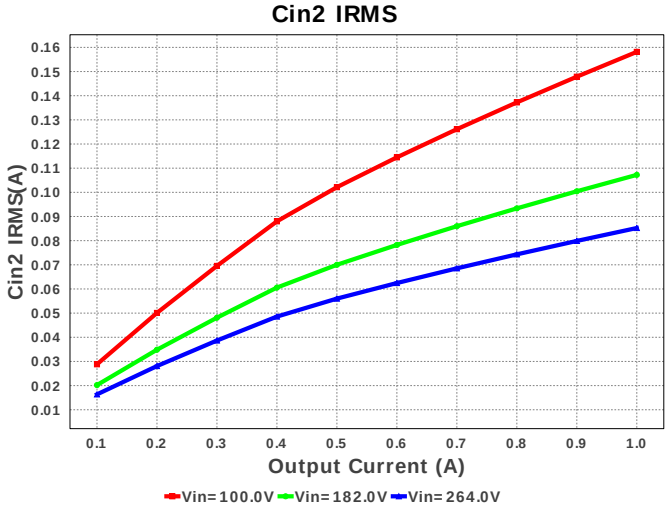


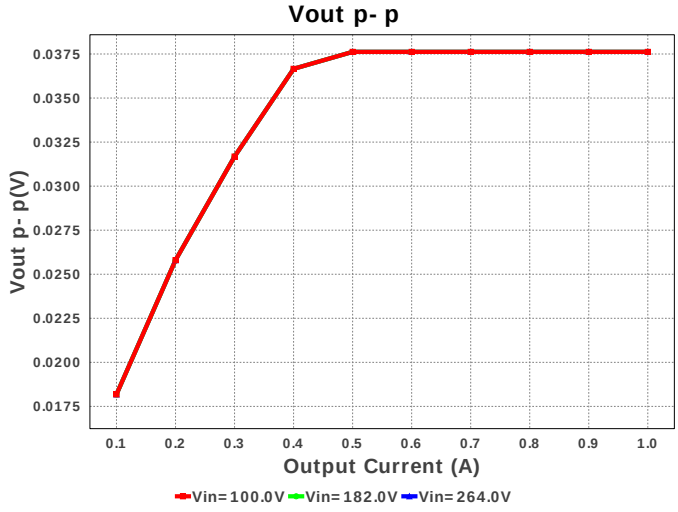


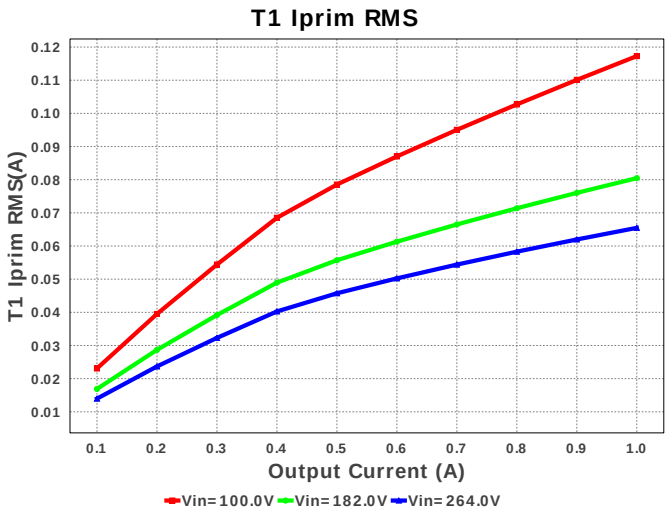


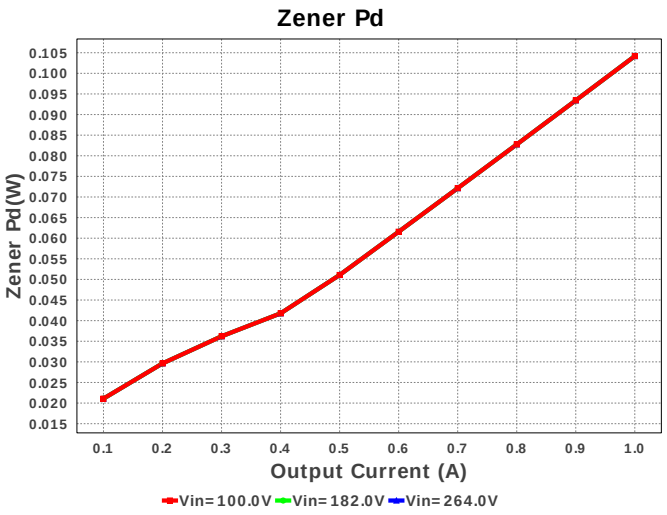


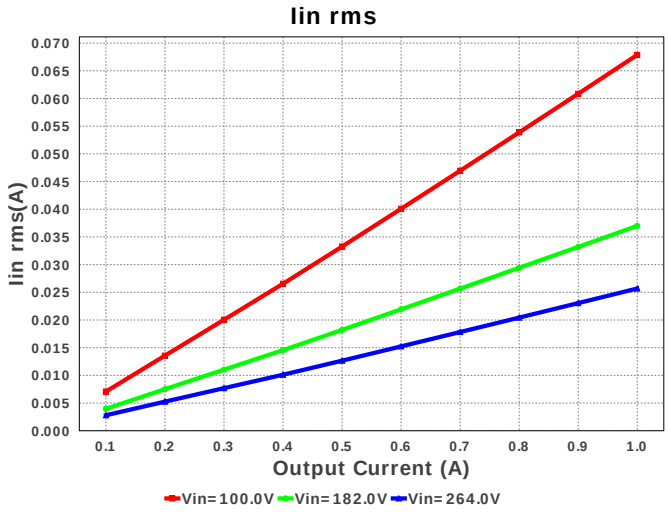


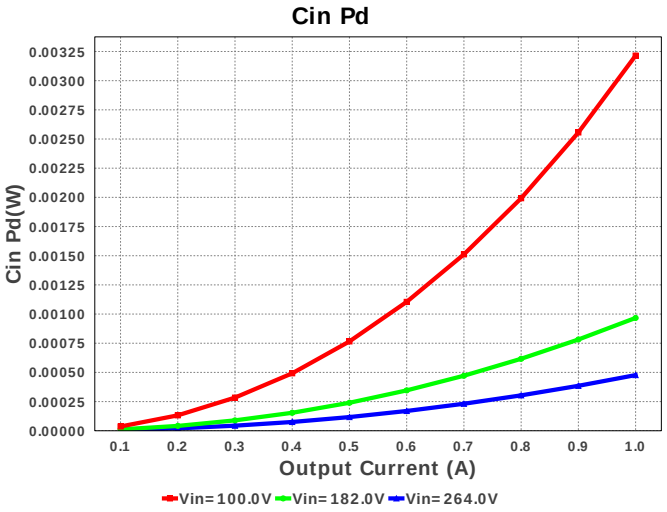


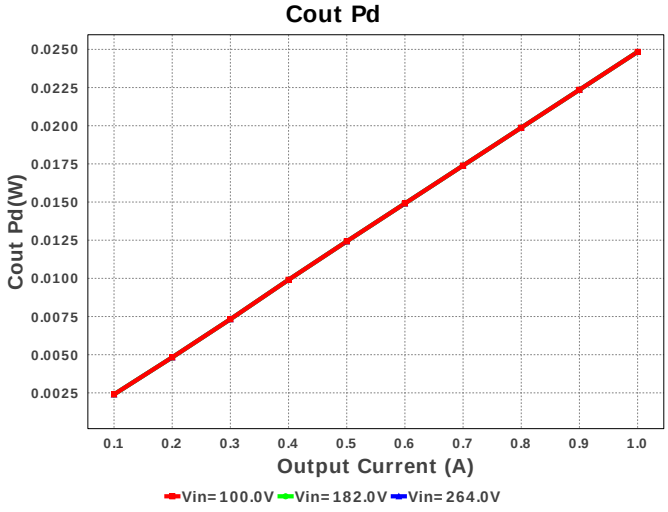


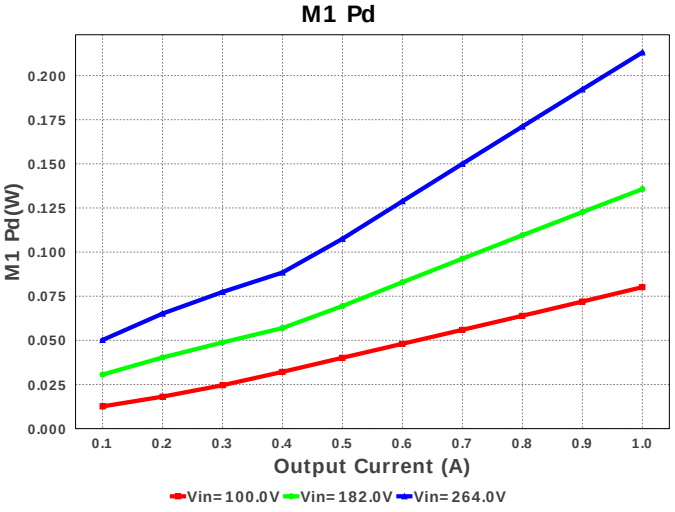


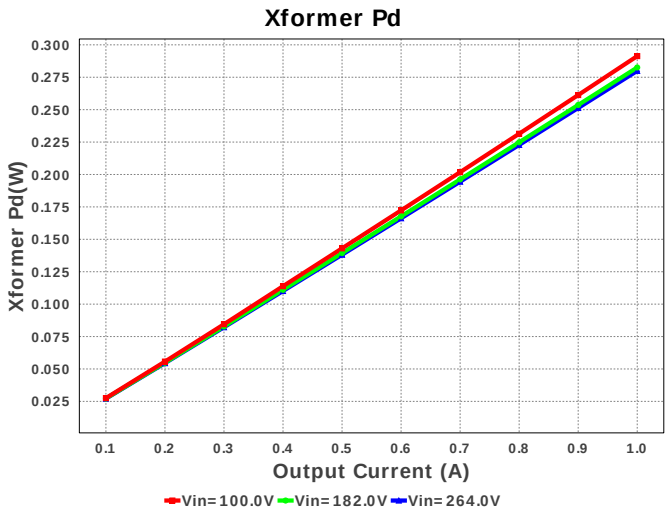


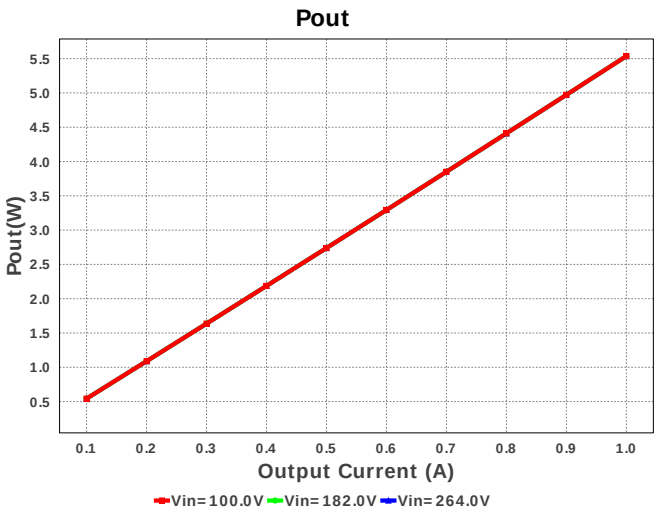


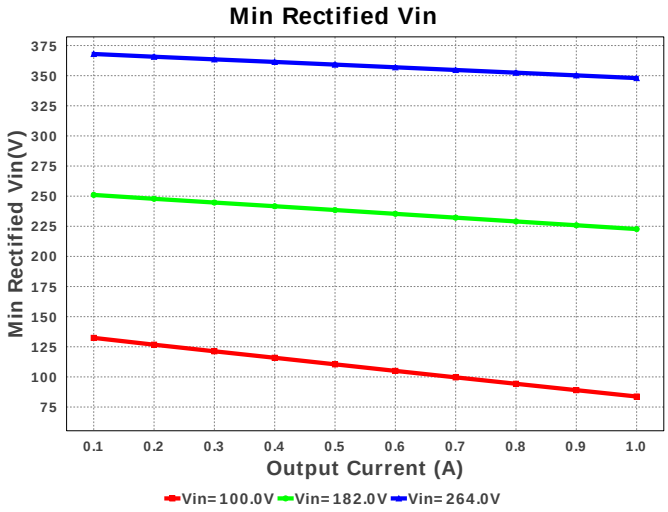


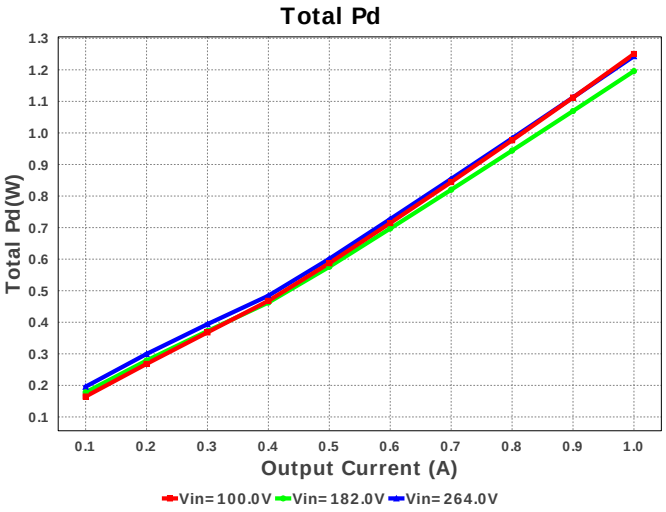


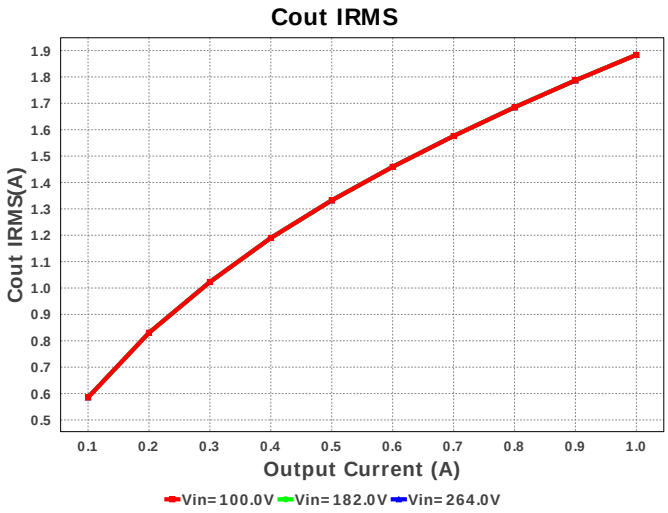


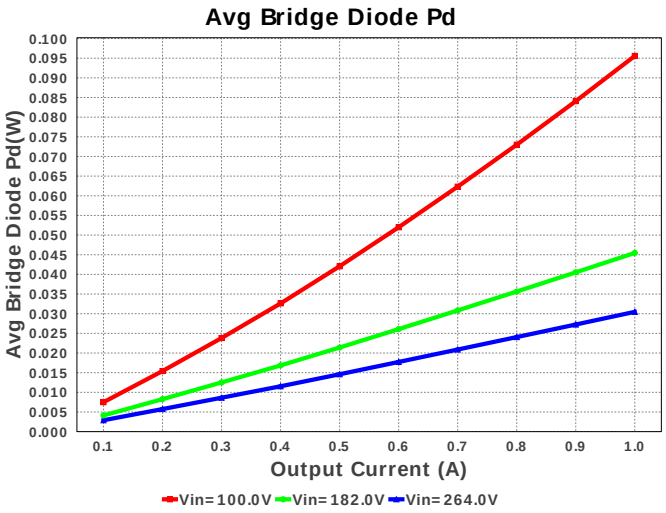


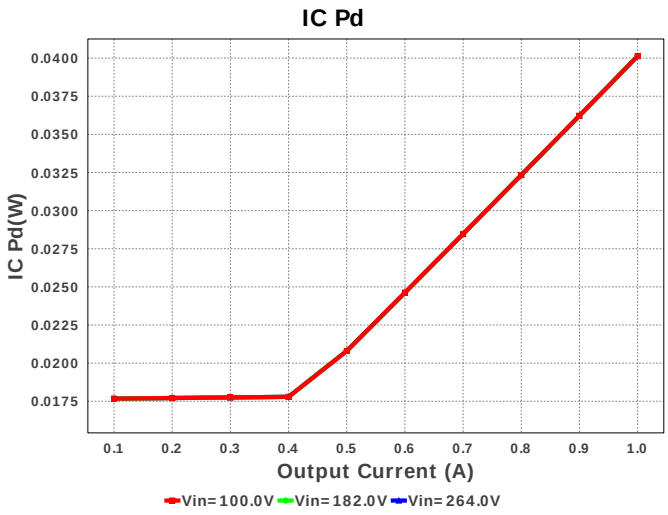


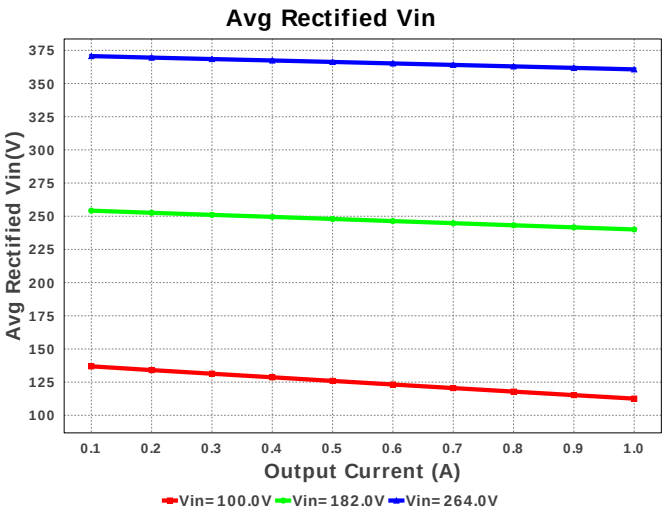


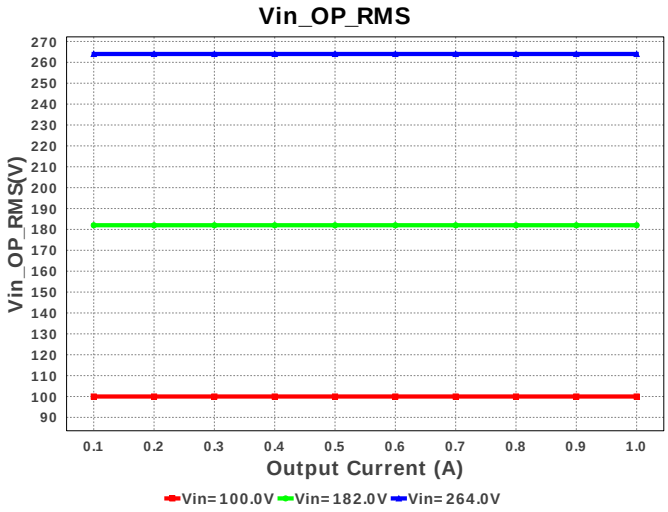


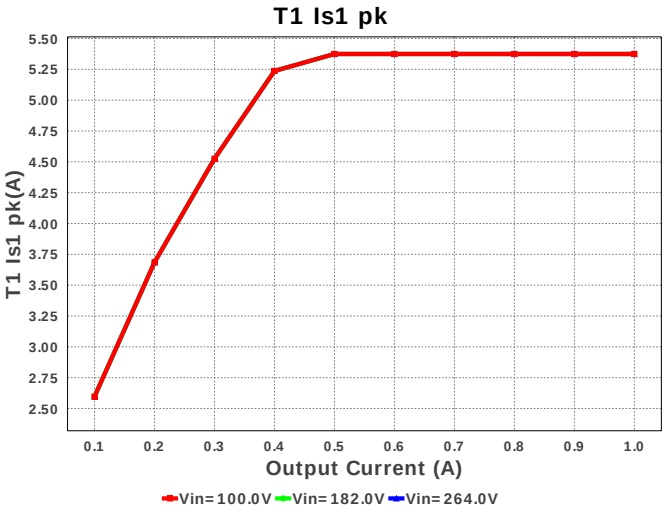


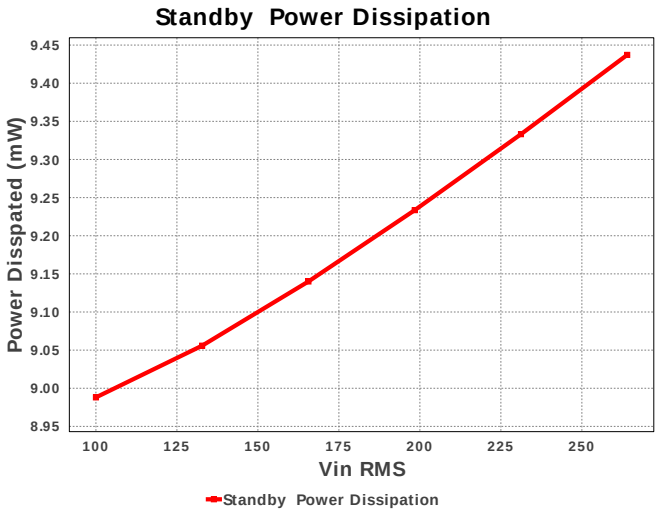


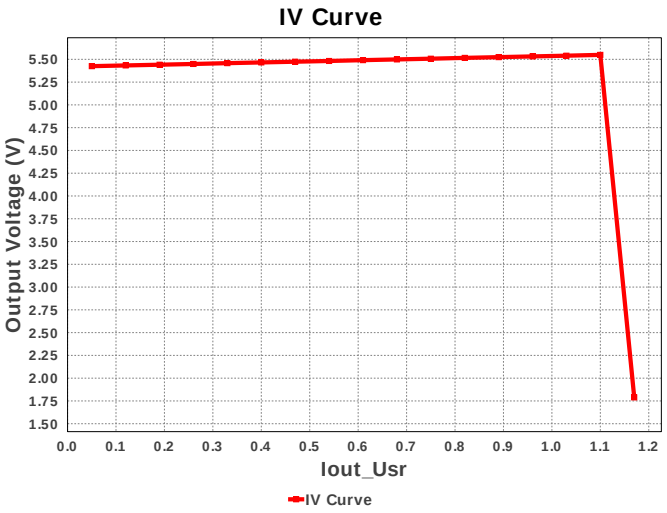












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	22.928 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	85.678 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	1.884 A	Current	Output capacitor RMS ripple current
4.	Iin rms	25.873 mA	Current	RMS Input Current
5.	T1 Iprim RMS	65.776 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	329.114 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	1.893 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	5.374 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	360.182 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	26	General	Total Design BOM count
11.	FootPrint	751.0 mm^2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Pout	5.538 W	General	Total output power
13.	Total BOM	$0.0	General	Total BOM Cost
14.	Vout OP	5.538 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	11.983 %	Op_point	Duty cycle
16.	Efficiency	81.076 %	Op_point	Steady state efficiency
17.	Frequency_	79.567 kHz	Op_point	Switching frequency
18.	IC Tj	32.83 degC	Op_point	IC junction temperature
19.	ICThetaJA	70.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	1.0 A	Op_point	Iout operating point
21.	M1 TjOP	51.384 degC	Op_point	M1 MOSFET junction temperature
22.	Min Rectified Vin	347.016 V	Op_point	Minimum voltage seen at rectified input
23.	Peak Rectified Vin	373.349 V	Op_point	Peak voltage seen at rectified input
24.	Vin_OP_RMS	264.0 V	Op_point	AC Input RMS Voltage
25.	Vout p-p	37.621 mV	Op_point	Peak-to-peak output ripple voltage
26.	Avg Bridge Diode Pd	25.686 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
27.	Cin Pd	485.038 µW	Power	Input capacitor power dissipation
28.	Cout Pd	24.838 mW	Power	Output capacitor power dissipation
29.	Diode2 Pd	419.991 mW	Power	Diode2 power dissipation
30.	IC Pd	40.425 mW	Power	IC power dissipation
31.	M1 Pd	213.838 mW	Power	M1 MOSFET total power dissipation
32.	Total Pd	1.293 W	Power	Total Power Dissipation
33.	Xformer Pd	281.329 mW	Power	Transformer power dissipation
34.	Zener Pd	105.596 mW	Power	Zener power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	Iout1	1.0	Output Current #1
3.	VinMax	264.0	Maximum input voltage
4.	VinMin	100.0	Minimum input voltage
5.	Vout	5.0	Output Voltage
6.	Vout1	5.0	Output Voltage #1
7.	base_pn	UCC28710	Texas Instruments Base Part 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 UCC28710 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/ucc28710.pdf

2. UCC28710 Product Folder : http://www.ti.com/product/UCC28710 : contains the data sheet and other resources.