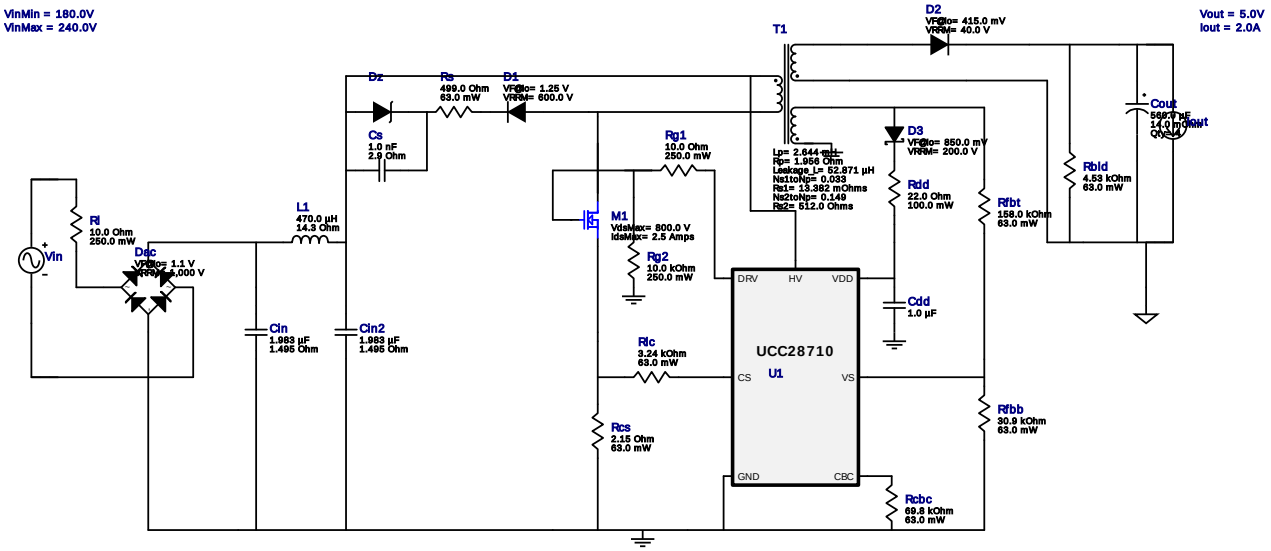
WEBENCH® Design Report

VinMin = 180.0V
VinMax = 240.0V
Vout = 5.0V
Iout = 2.0A

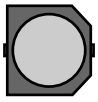
Device = UCC28710DR
Topology = Flyback
Created = 6/12/14 4:46:39 AM
BOM Cost = $0.00
Footprint = 945.0mm2
BOM Count = 28
Total Pd = 2.49W

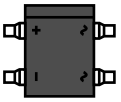
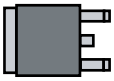
Design : 3718911/304 UCC28710DR
UCC28710DR 180.0V-240.0V to 5.113V @ 2.0A

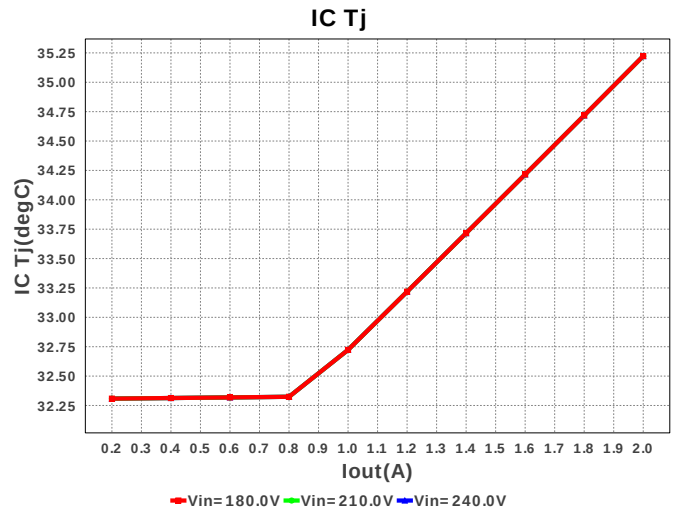


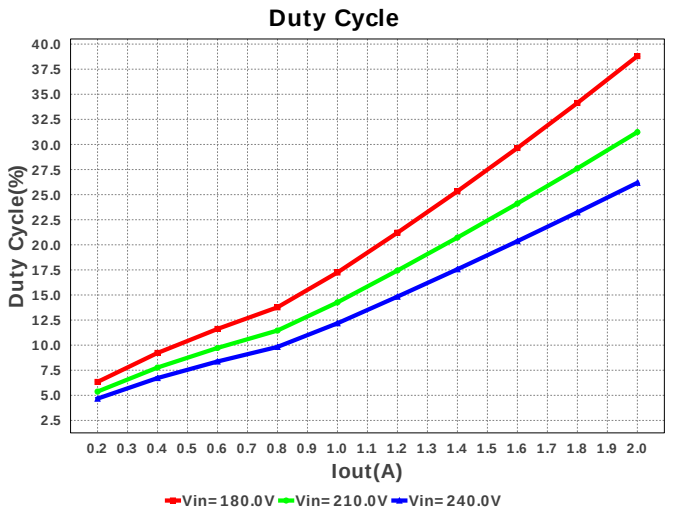
1. Rbld is a starting point, but may need to be experimented with in order to get minimum current needed to hold Vout at no load. Rlc and the feedback resistors may also need adjustment based on the actual transformer used. For more information please click the design assistance button.

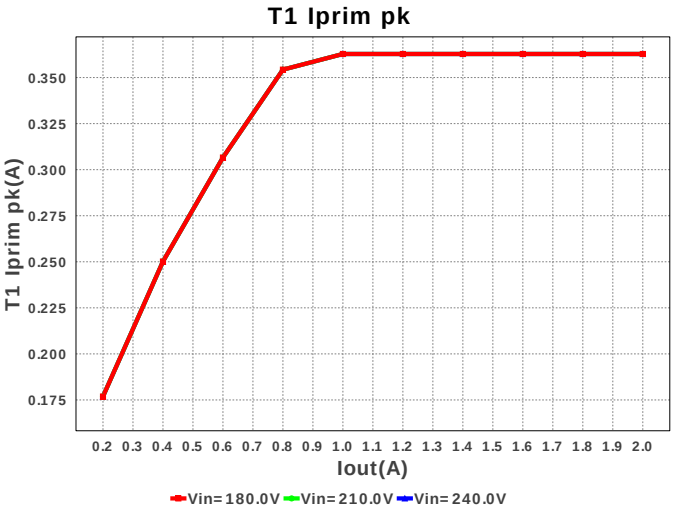
Electrical BOM

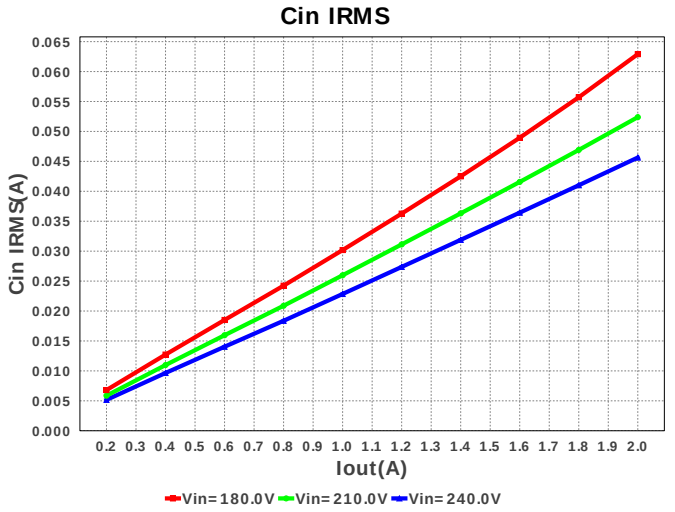
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdd	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 µF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5mm2
2.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 1.983 µF ESR= 1.495 Ohm VDC= 509.112 V IRMS= 252.393 mA	1	NA	CUSTOM 0mm2
3.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 1.983 µF ESR= 1.495 Ohm VDC= 509.112 V IRMS= 252.393 mA	1	NA	CUSTOM 0mm2
4.	Cout	Panasonic	16SVPF560M Series= 1273	Cap= 560.0 µF ESR= 14.0 mOhm VDC= 16.0 V IRMS= 4.95 A	4	$0.61	 CAPSMT_62_E12 106mm2
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 5mm2
6.	D1	Diodes Inc.	MURS160-13-F	VF@Io= 1.25 V VRRM= 600.0 V	1	$0.11	 SMB 44mm2
7.	D2	ON Semiconductor	MBRA340T3G	VF@Io= 415.0 mV VRRM= 40.0 V	1	$0.19	 SMA 37mm2
8.	D3	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	$0.21	 PowerDI123 13mm2

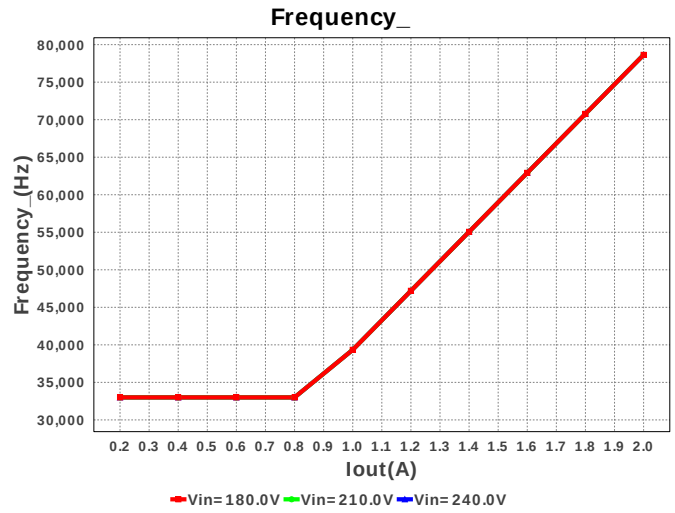
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000 V	1	$0.24	 DF-S 99mm2
10.	Dz	ON Semiconductor	1SMB5956BT3G	Zener	1	$0.08	 SMB 44mm2
11.	L1	Bourns	SDR0302-471KL	L= 470.0 µH DCR= 14.3 Ohm	1	$0.17	 SDR0302 15mm2
12.	M1	ST Microelectronics	STD3NK80ZT4	VdsMax= 800.0 V IdsMax= 2.5 Amps	1	$0.68	 DPAK 102mm2
13.	Rbld	Vishay-Dale	CRCW04024K53FKED Series= CRCW..e3	Res= 4.53 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
14.	Rcbc	Vishay-Dale	CRCW040269K8FKED Series= CRCW..e3	Res= 69.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
15.	Rcs	Vishay-Dale	CRCW04022R15FKED Series= CRCW..e3	Res= 2.15 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
16.	Rdd	Yageo America	RC0603FR-0722RL Series= 233	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5mm2
17.	Rfbb	Vishay-Dale	CRCW040230K9FKED Series= CRCW..e3	Res= 30.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
18.	Rfbt	Vishay-Dale	CRCW0402158KFKED Series= CRCW..e3	Res= 158.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
19.	Rg1	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11mm2
20.	Rg2	Panasonic	ERJ-8ENF1002V Series= ERJ-8E	Res= 10.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11mm2
21.	Rl	Panasonic	ERJ-8ENF10R0V Series= ERJ-8E	Res= 10.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11mm2
22.	Rlc	Vishay-Dale	CRCW04023K24FKED Series= CRCW..e3	Res= 3.24 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
23.	Rs	Vishay-Dale	CRCW0402499RFKED Series= CRCW..e3	Res= 499.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
24.	T1	CUSTOM	CUSTOM	Lp= 2.644 mH Rp= 1.956 Ohm Leakage_L= 52.871 µH Ns1toNp= 0.033 Rs1= 13.382 mOhms Ns2toNp= 0.149 Rs2= 512.0 Ohms	1	NA	CUSTOM 0mm2
25.	U1	Texas Instruments	UCC28710DR	Switcher	1	$0.42	 SOIC-7 0mm2

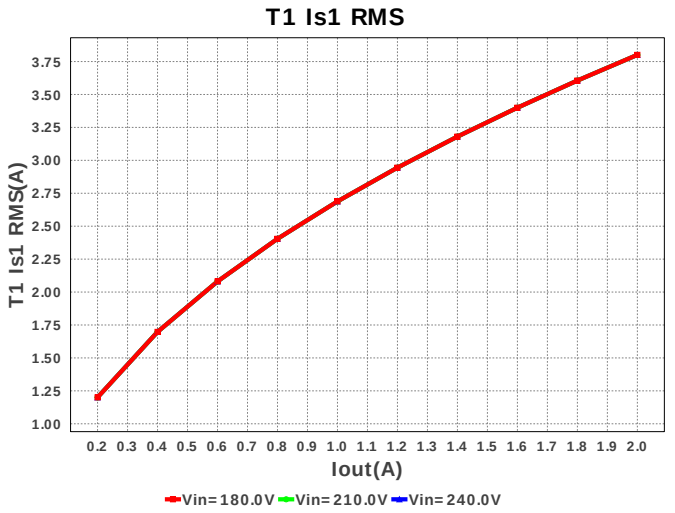


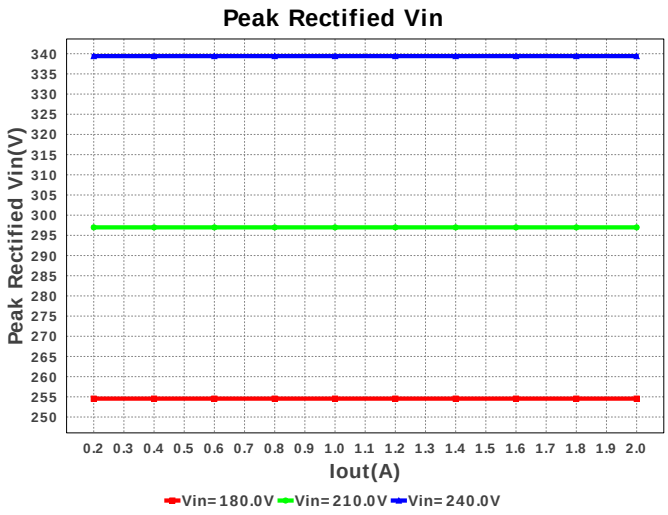


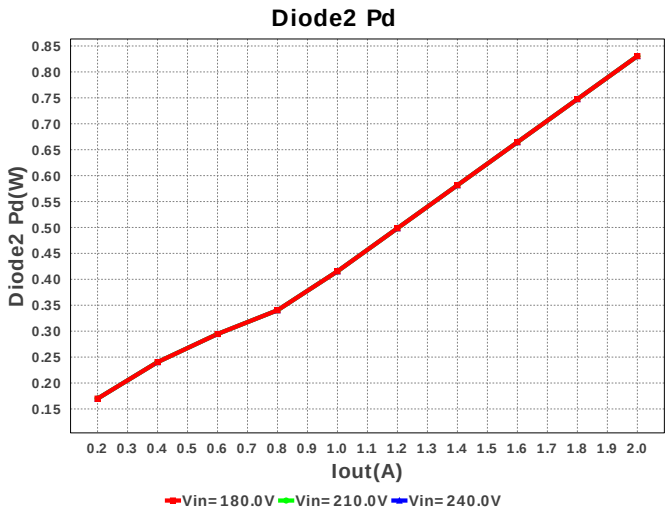


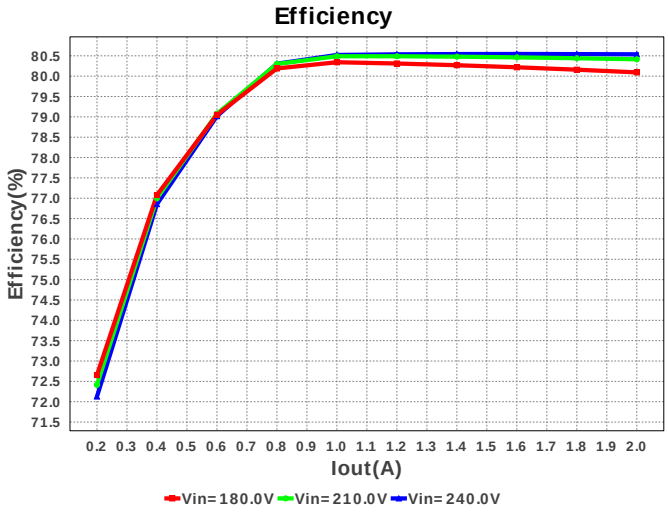


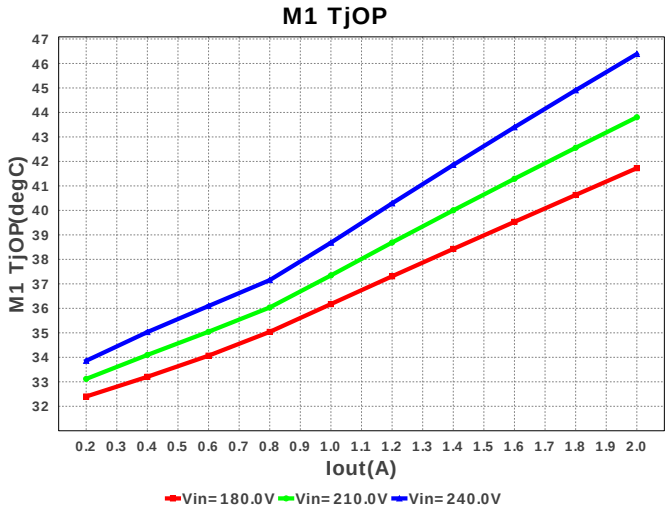


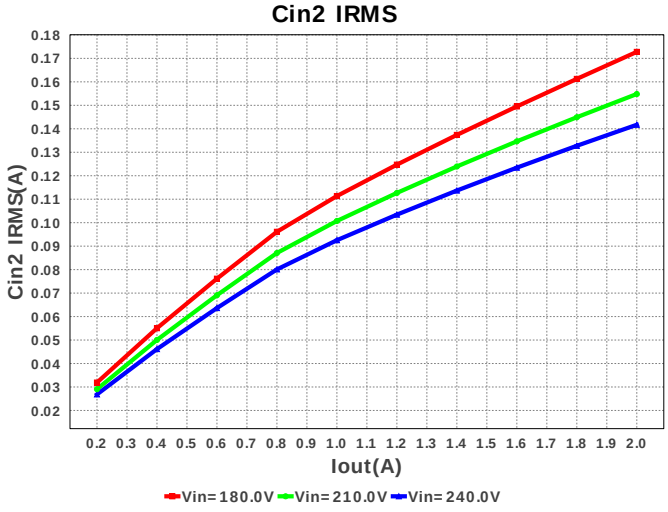


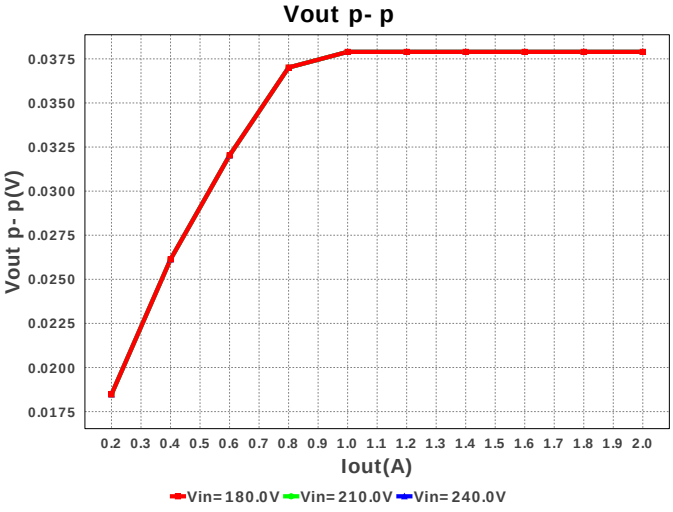


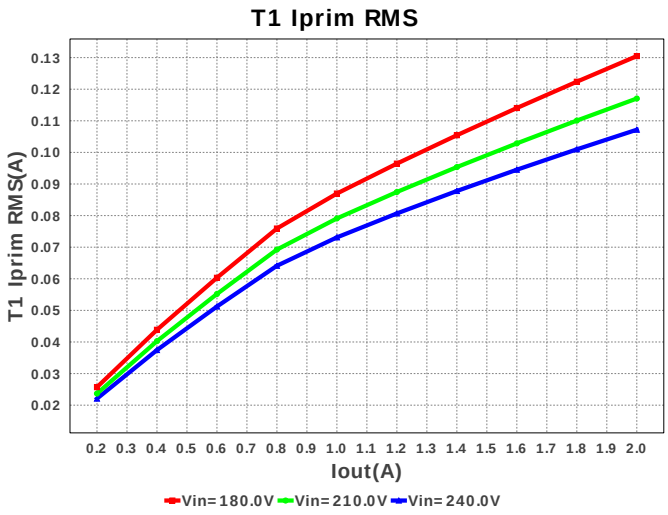


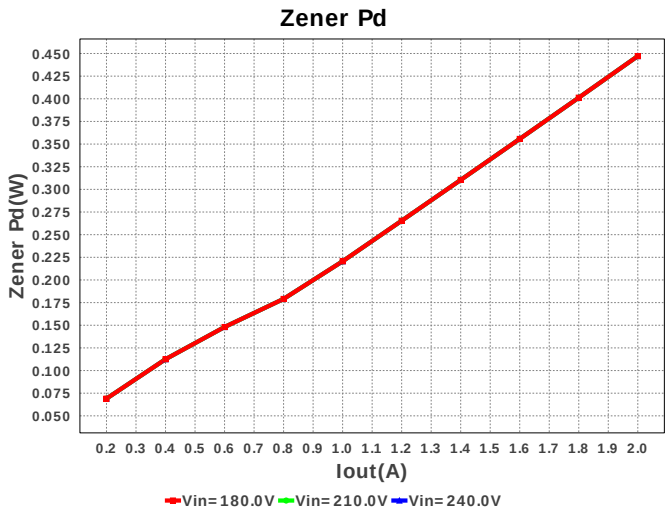


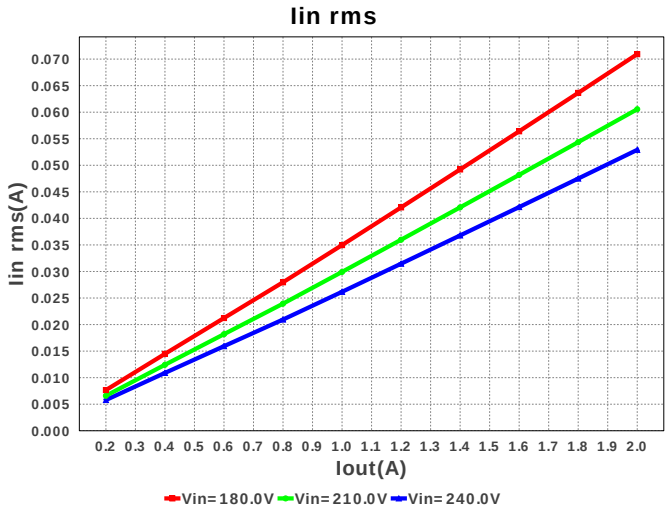


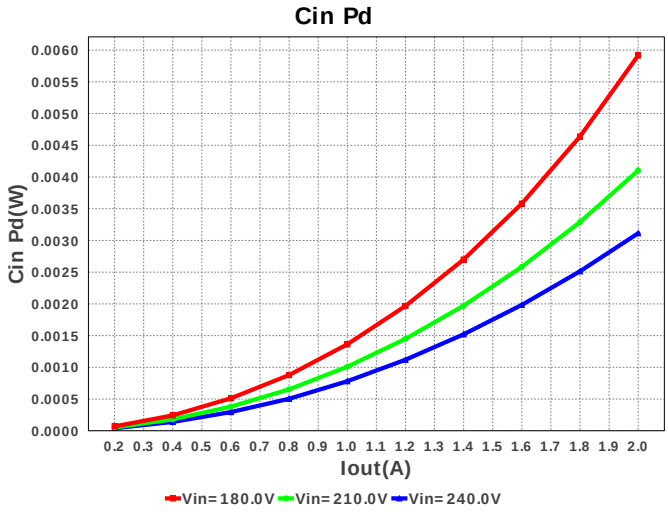


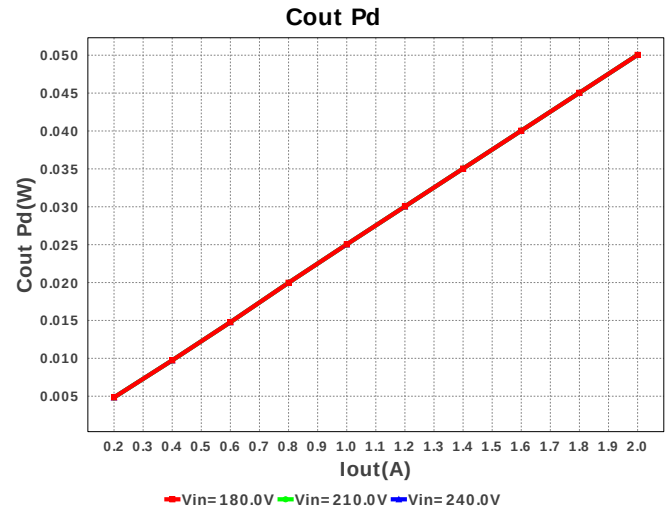


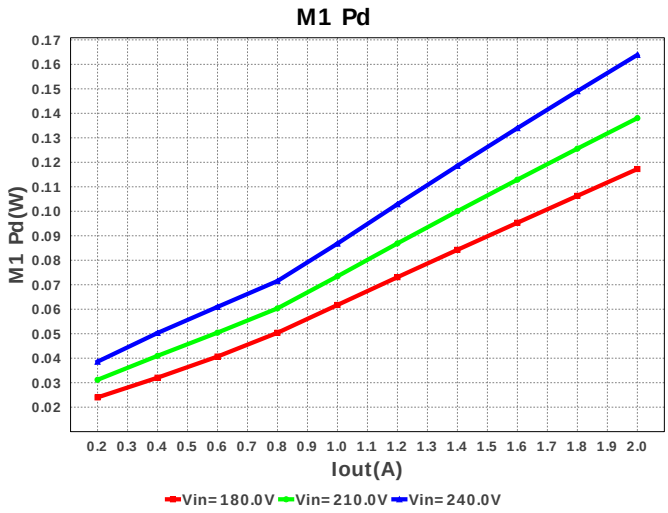


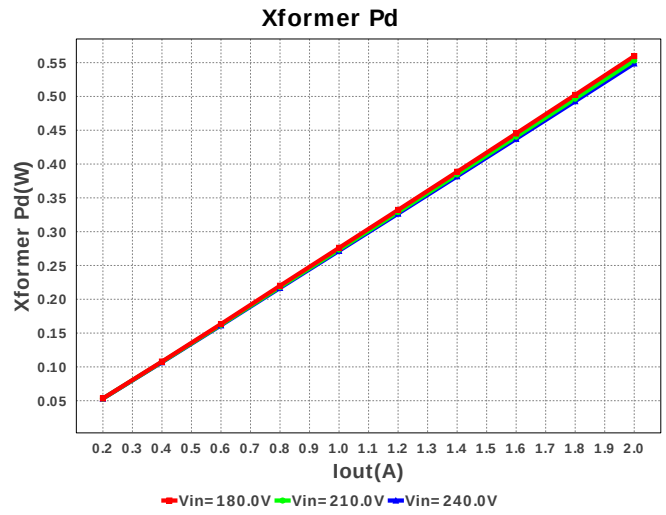


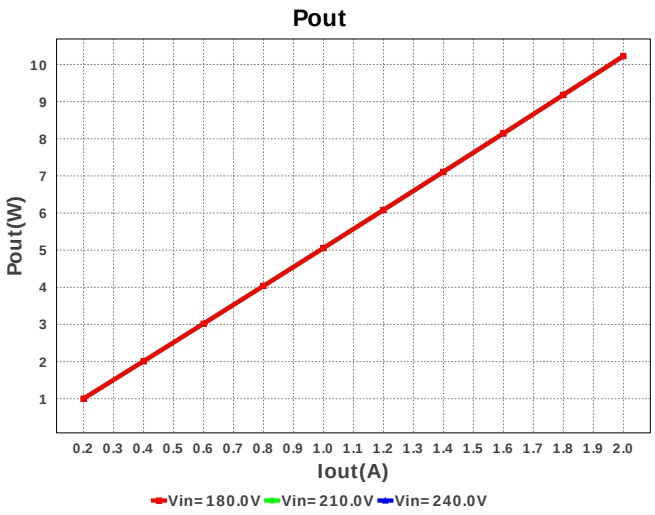


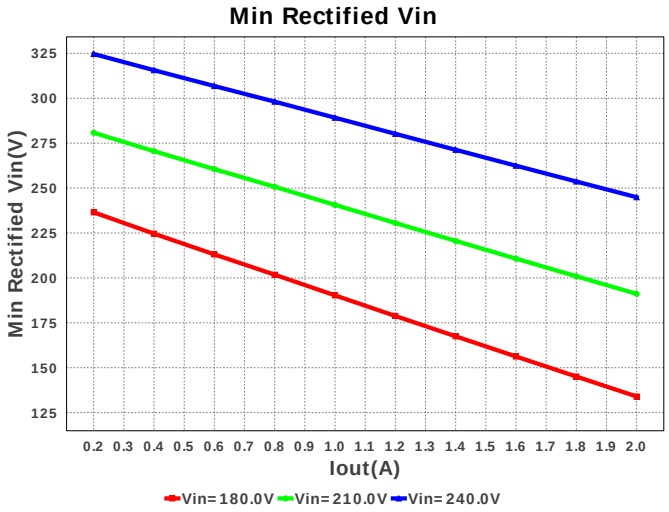


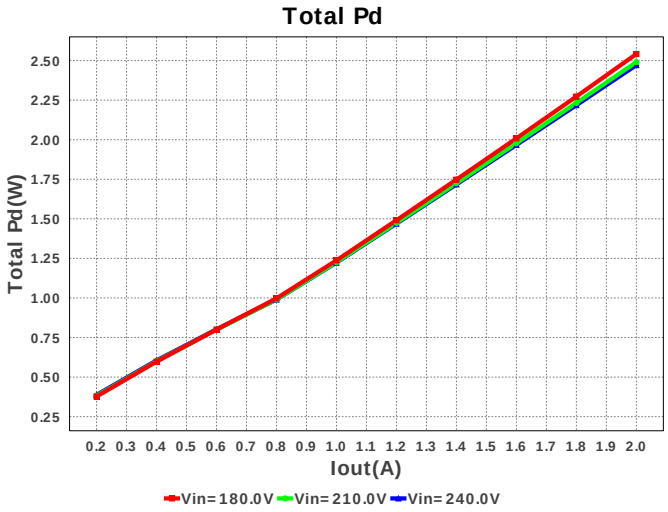


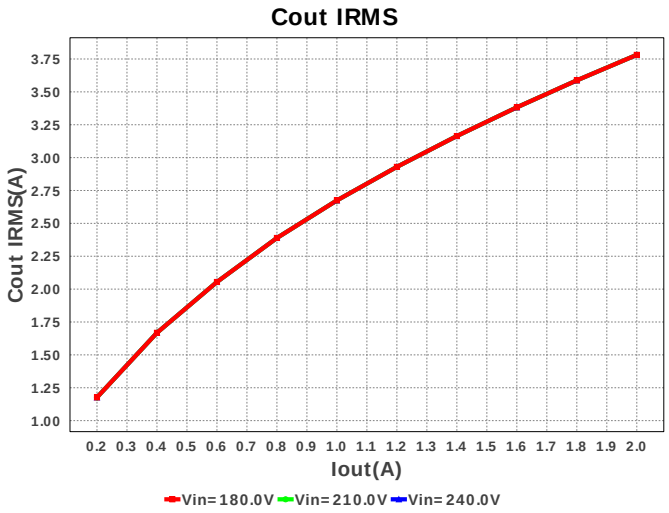


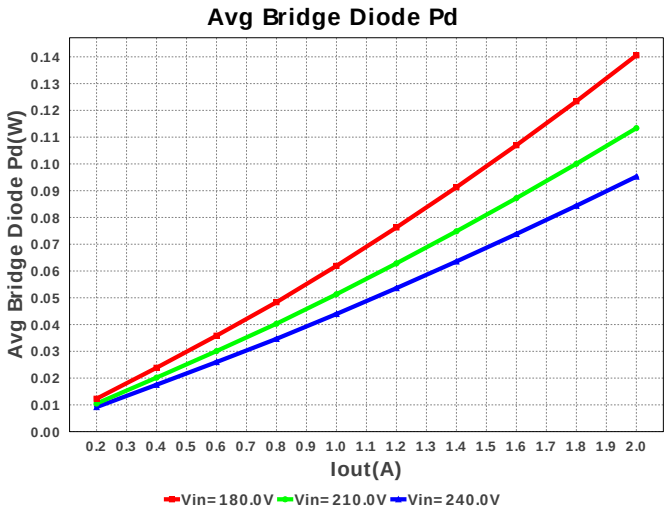


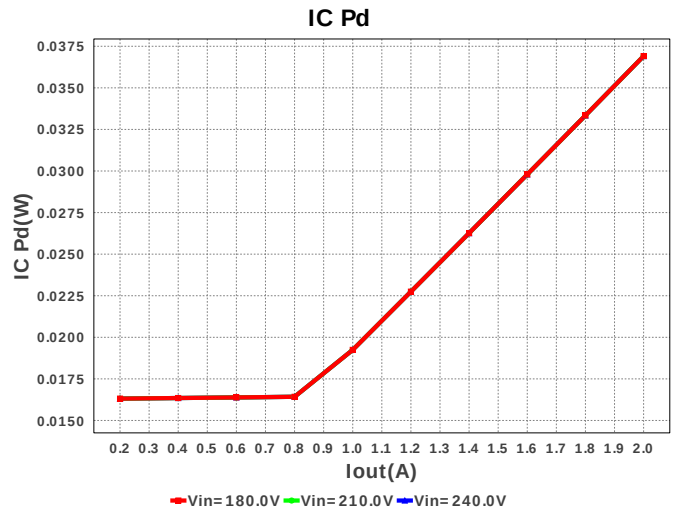


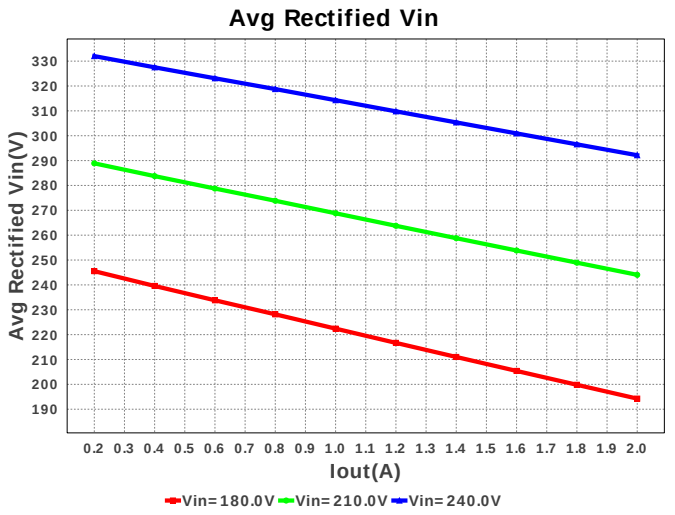


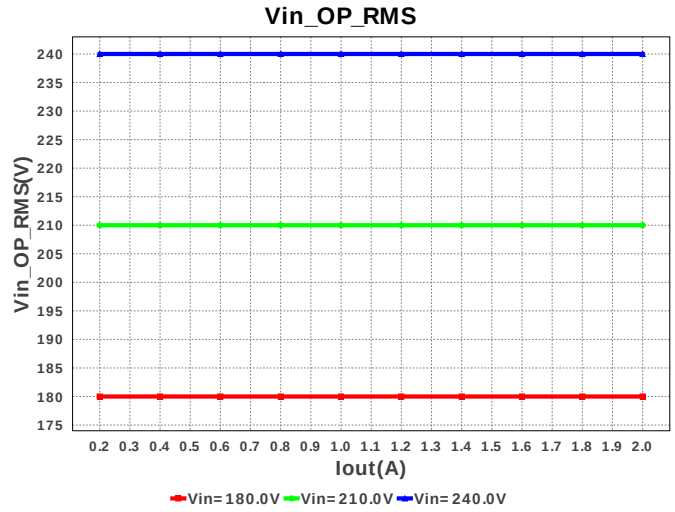


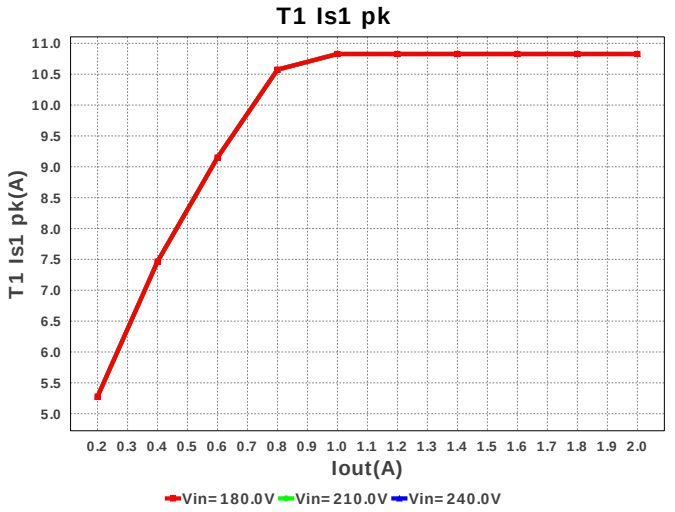


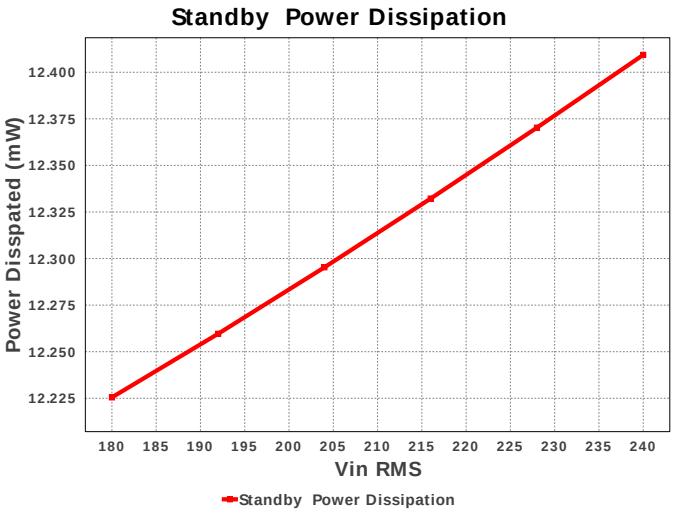


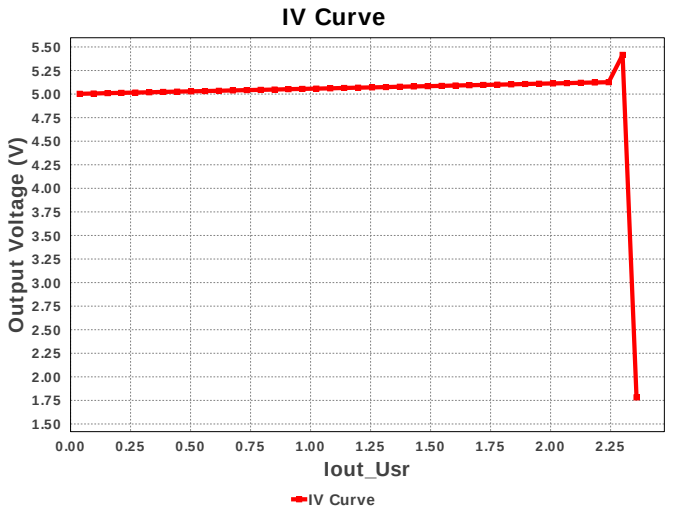












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	45.893 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	141.049 mA	Current	Input capacitor2 RMS ripple current
3.	Cout IRMS	3.781 A	Current	Output capacitor RMS ripple current
4.	Iin rms	52.977 mA	Current	RMS Input Current
5.	T1 Iprim RMS	105.822 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	362.791 mA	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	3.801 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	10.828 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	300.053 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	28	General	Total Design BOM count
11.	FootPrint	945.0 mm2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Pout	10.226 W	General	Total output power
13.	Total BOM	$0.0	General	Total BOM Cost
14.	Vout OP	5.113 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	25.525 %	Op_point	Duty cycle
16.	Efficiency	80.429 %	Op_point	Steady state efficiency
17.	Frequency_	78.636 kHz	Op_point	Switching frequency
18.	IC Tj	32.584 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	46.826 degC	Op_point	M1 MOSFET junction temperature
22.	Min Rectified Vin	260.697 V	Op_point	Minimum voltage seen at rectified input
23.	Peak Rectified Vin	339.408 V	Op_point	Peak voltage seen at rectified input
24.	Vin_OP_RMS	240.0 V	Op_point	AC Input RMS Voltage
25.	Vout p-p	37.897 mV	Op_point	Peak-to-peak output ripple voltage
26.	Avg Bridge Diode Pd	92.904 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
27.	Cin Pd	3.148 mW	Power	Input capacitor power dissipation
28.	Cout Pd	50.045 mW	Power	Output capacitor power dissipation
29.	Diode2 Pd	830.496 mW	Power	Diode2 power dissipation
30.	IC Pd	36.909 mW	Power	IC power dissipation
31.	M1 Pd	168.256 mW	Power	M1 MOSFET total power dissipation
32.	Total Pd	2.488 W	Power	Total Power Dissipation
33.	Xformer Pd	548.284 mW	Power	Transformer power dissipation
34.	Zener Pd	447.123 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	240.0 V	Maximum input voltage
4.	VinMin	180.0 V	Minimum input voltage
5.	Vout	5.0 V	Output Voltage
6.	Vout1	5.0 Volt	Output Voltage #1
7.	base_pn	UCC28710	Texas Instruments Base Part 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 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.