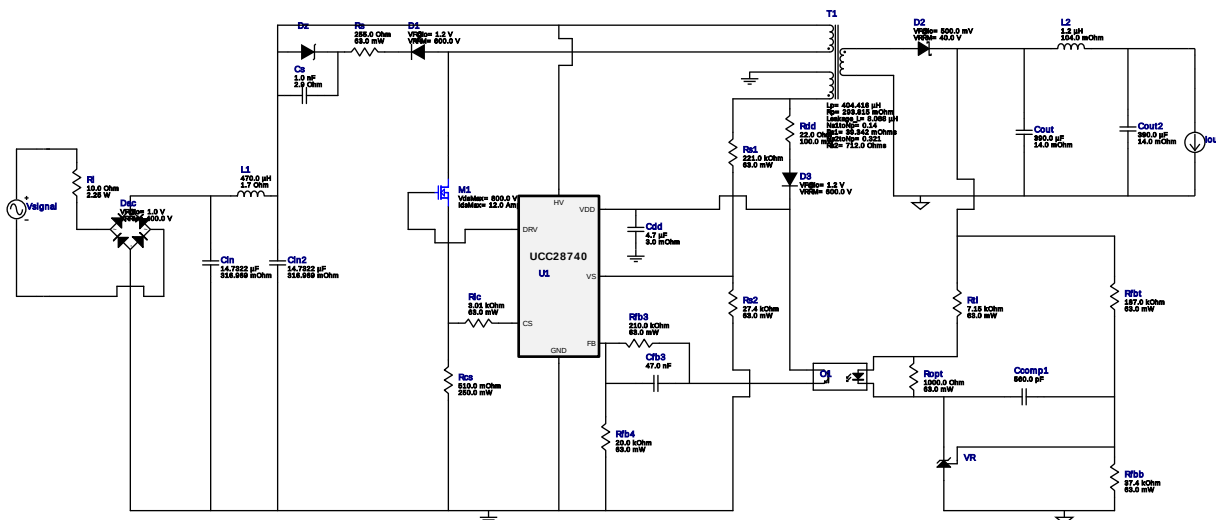


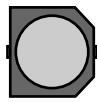
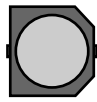
WEBENCH® Design Report

Design : 906020/2238 UCC28740DR
UCC28740DR 110.0V-130.0V to 15.00V @ 2.0A



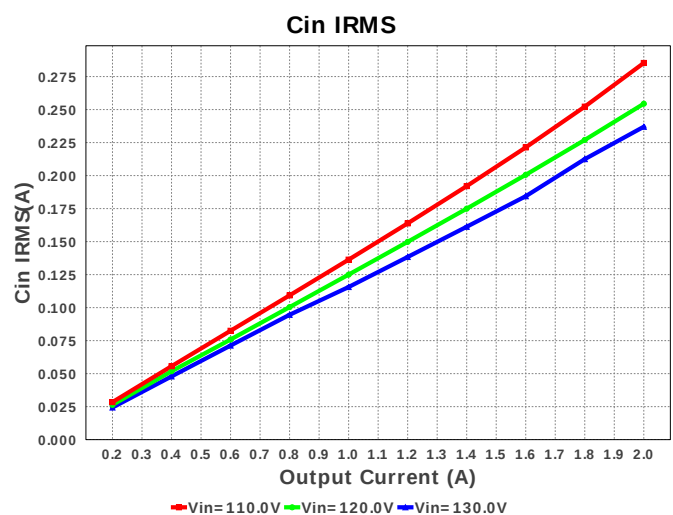
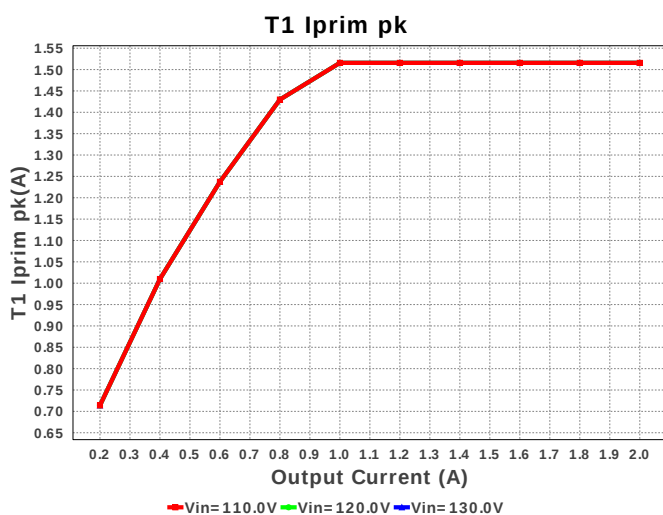
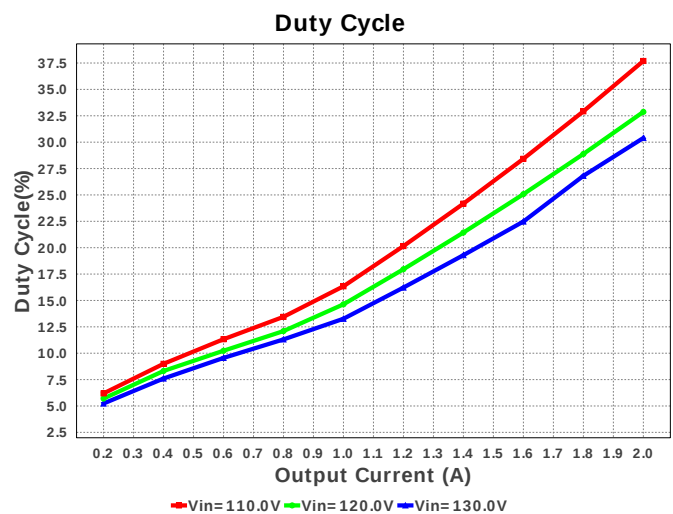
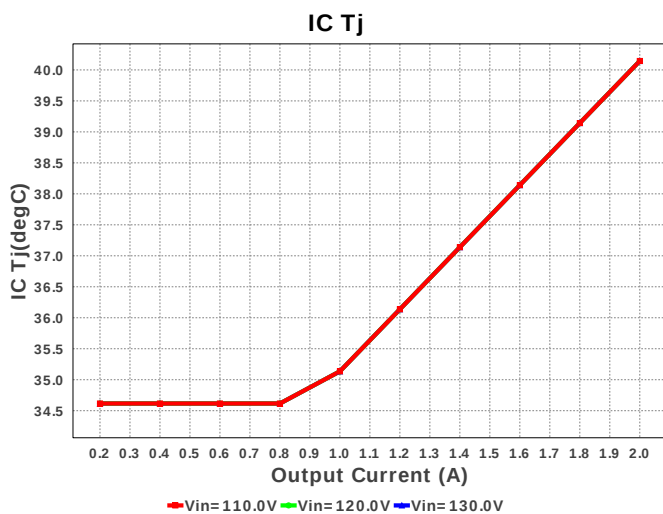
1. Rlc, Rtl and the feedback resistors for this design are a starting point, but may need adjustment based on the actual transformer used. For more information please click the design assistance button.

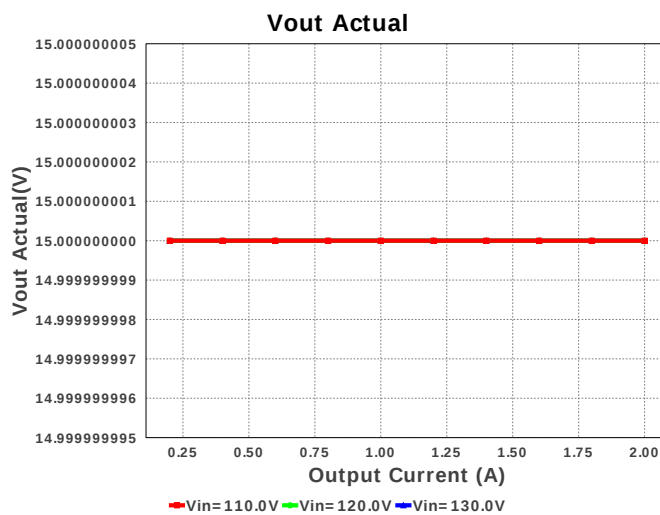
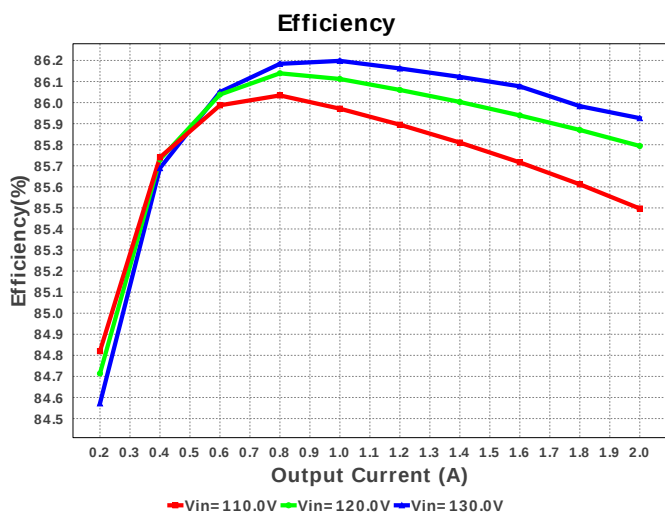
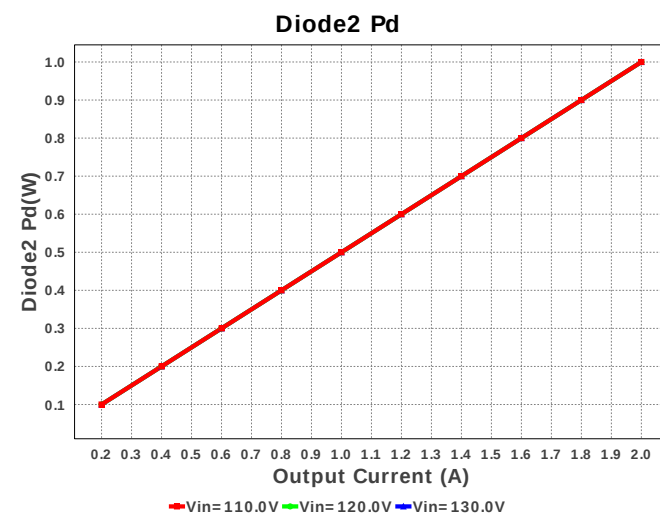
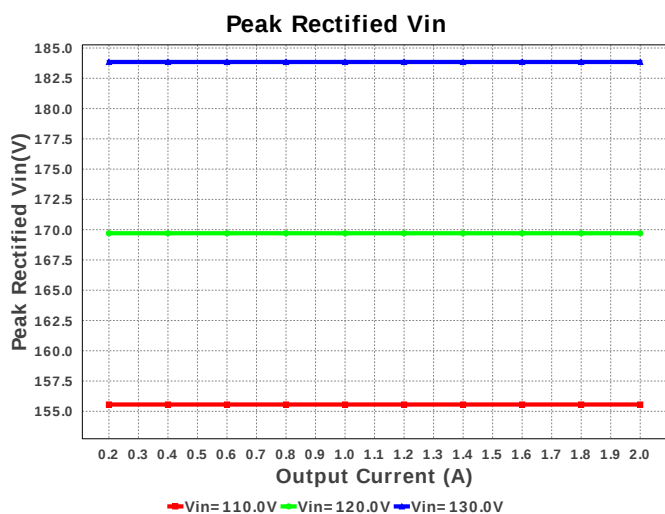
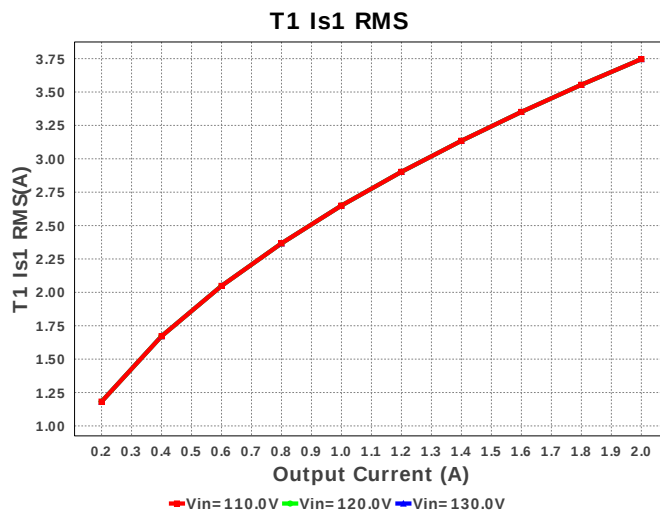
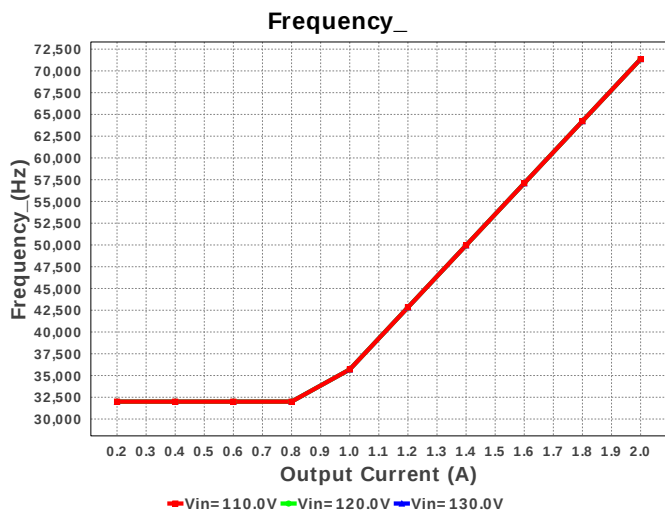
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp1	Yageo America	CC0805KRX7R9BB561 Series= X7R	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
2.	Cdd	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	\$0.07	 1206 11 mm ²
3.	Cfb3	Taiyo Yuden	TMK212B7473KD-T Series= X7R	Cap= 47.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
4.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 14.7322 uF ESR= 316.97 mOhm VDC= 275.769 V IRMS= 424.552 mA	1	NA	CUSTOM 0 mm ²
5.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 14.7322 uF ESR= 316.97 mOhm VDC= 275.769 V IRMS= 424.552 mA	1	NA	CUSTOM 0 mm ²
6.	Cout	Panasonic	20SVPF390M Series= ?	Cap= 390.0 uF ESR= 14.0 mOhm VDC= 20.0 V IRMS= 4.95 A	1	\$0.63	 CAPSMT_62_E12 106 mm ²
7.	Cout2	Panasonic	20SVPF390M Series= ?	Cap= 390.0 uF ESR= 14.0 mOhm VDC= 20.0 V IRMS= 4.95 A	1	\$0.63	 CAPSMT_62_E12 106 mm ²
8.	Cs	MuRata	GRM188R72E102KW07D Series= X7R	Cap= 1.0 nF ESR= 2.9 Ohm VDC= 250.0 V IRMS= 90.0 mA	1	\$0.01	 0603 5 mm ²

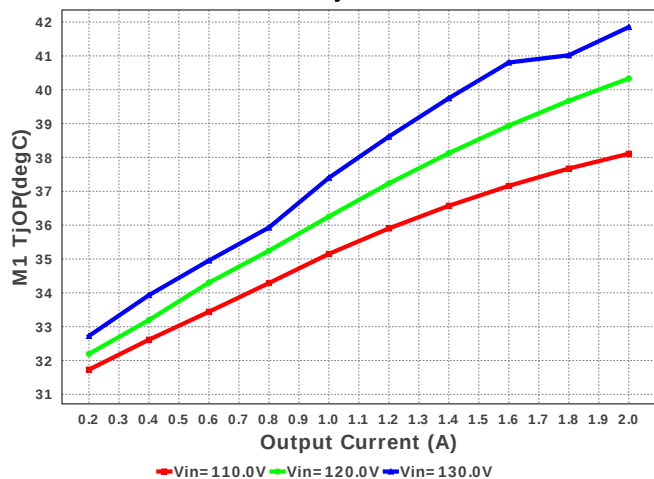
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	D1	Bourns	CD214B-F3600	VF@Io= 1.2 V VRRM= 600.0 V	1	\$0.14	 SMB 44 mm²
10.	D2	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	\$0.11	 SMA 37 mm²
11.	D3	ON Semiconductor	1N4937G	VF@Io= 1.2 V VRRM= 600.0 V	1	\$0.04	 DO-41 43 mm²
12.	Dac	Diodes Inc.	HD04-T	VF@Io= 1.0 V VRRM= 400.0 V	1	\$0.12	 MiniDIP 62 mm²
13.	Dz	ON Semiconductor	1SMB5952BT3G	Zener	1	\$0.10	 SMB 44 mm²
14.	L1	TDK	CLF7045T-471M	L= 470.0 µH DCR= 1.7 Ohm	1	\$0.42	 CLF7045 86 mm²
15.	L2	TDK	MLP2520S1R0ST0S1	L= 1.2 µH DCR= 104.0 mOhm	1	\$0.14	 MLP2520S-S 12 mm²
16.	M1	STMicroelectronics	STW13N80K5	VdsMax= 800.0 V IdsMax= 12.0 Amps	1	\$2.00	 TO-247 123 mm²
17.	O1	California Eastern Laboratories	PS2811-1	Optocoupler	1	\$0.38	 SSOP-4 111 mm²
18.	Rcs	Bourns	CRM0805-FX-R510ELF Series= ?	Res= 510.0 mOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.03	 0805 7 mm²
19.	Rdd	Yageo America	RC0603FR-0722RL Series= ?	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm²
20.	Rfb3	Vishay-Dale	CRCW0402210KFKED Series= CRCW..e3	Res= 210.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
21.	Rfb4	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
22.	Rfbb	Vishay-Dale	CRCW040237K4FKED Series= CRCW..e3	Res= 37.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
23.	Rfbt	Vishay-Dale	CRCW0402187KFKED Series= CRCW..e3	Res= 187.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
24.	RI	Vishay-Dale	AC03000001009JACCS Series= F_RES	Res= 10.0 Ohm Power= 2.25 W Tolerance= 5.0%	1	\$0.30	 AC03 158 mm²
25.	Rlc	Vishay-Dale	CRCW04023K01FKED Series= CRCW..e3	Res= 3.01 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
26.	Ropt	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
27.	Rs	Vishay-Dale	CRCW0402255RFKED Series= CRCW..e3	Res= 255.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
28.	Rs1	Vishay-Dale	CRCW0402221KFKED Series= CRCW..e3	Res= 221.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
29.	Rs2	Vishay-Dale	CRCW040227K4FKED Series= CRCW..e3	Res= 27.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
30.	Rtl	Vishay-Dale	CRCW04027K15FKED Series= CRCW..e3	Res= 7.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
31.	T1	CUSTOM	CUSTOM	Lp= 404.416 µH Rp= 293.815 mOhm Leakage_L= 8.088 µH Ns1toNp= 0.14 Rs1= 39.342 mOhms Ns2toNp= 0.321 Rs2= 712.0 Ohms	1	NA	CUSTOM 0 mm²
32.	U1	Texas Instruments	UCC28740DR	Switcher	1	\$0.42	 R-PDSO-G7 55 mm²
33.	VR	Texas Instruments	TL431AIDBVR	Voltage References	1	\$0.07	 R-PDSO-G3 16 mm²

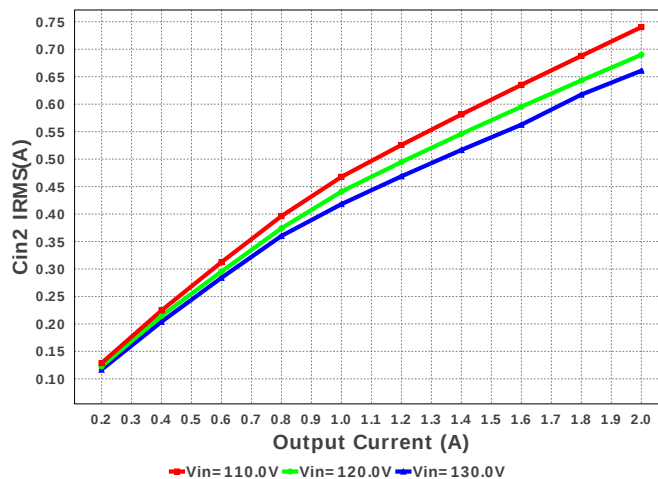




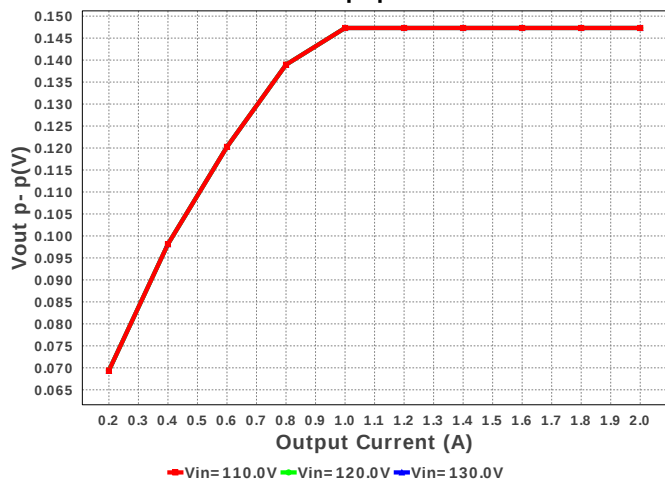
M1 TjOP



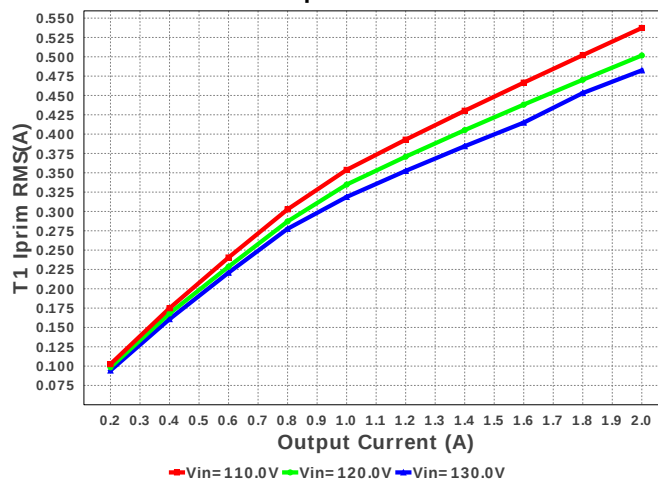
Cin2 IRMS



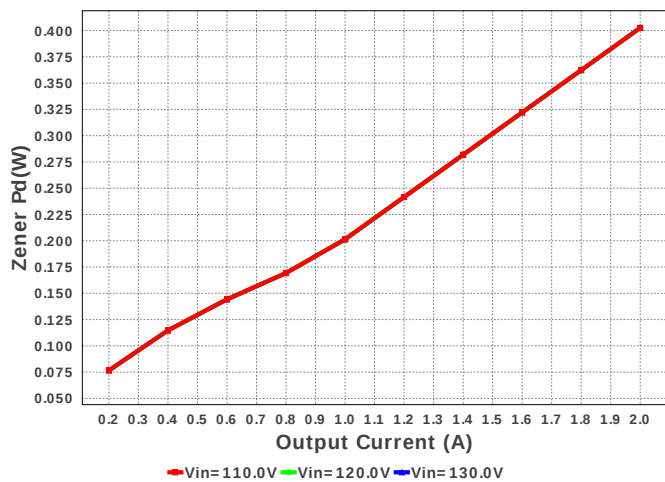
Vout p- p



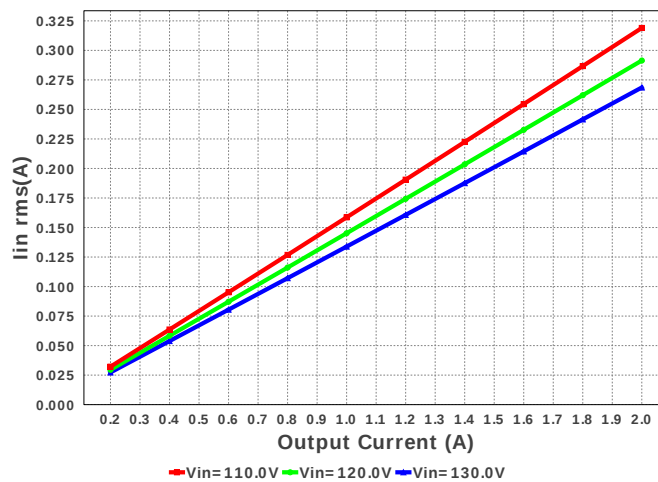
T1 Iprim RMS

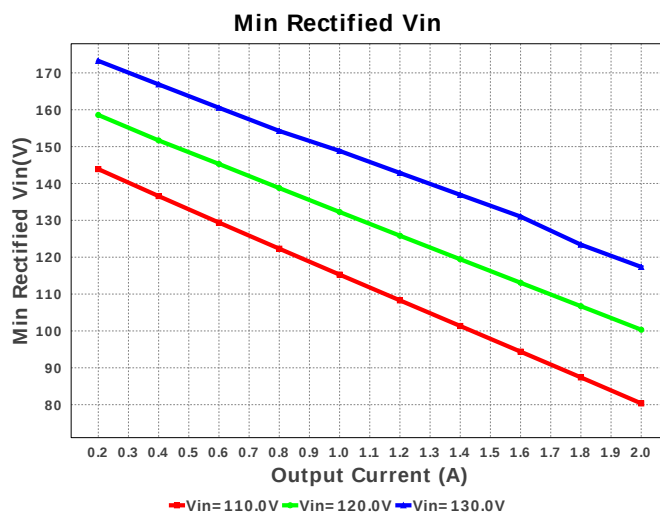
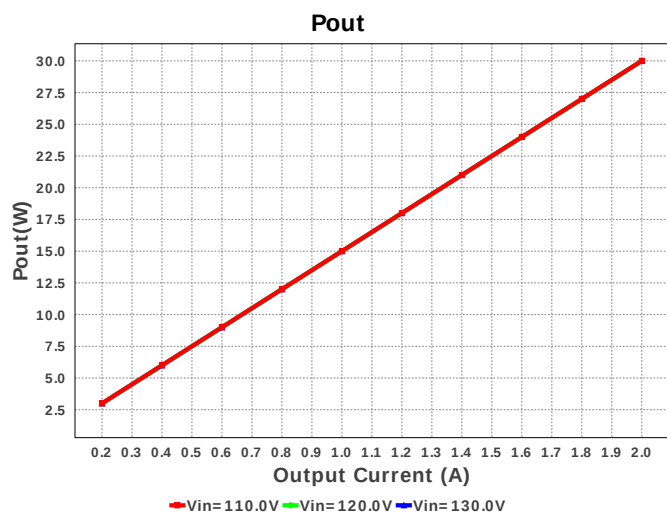
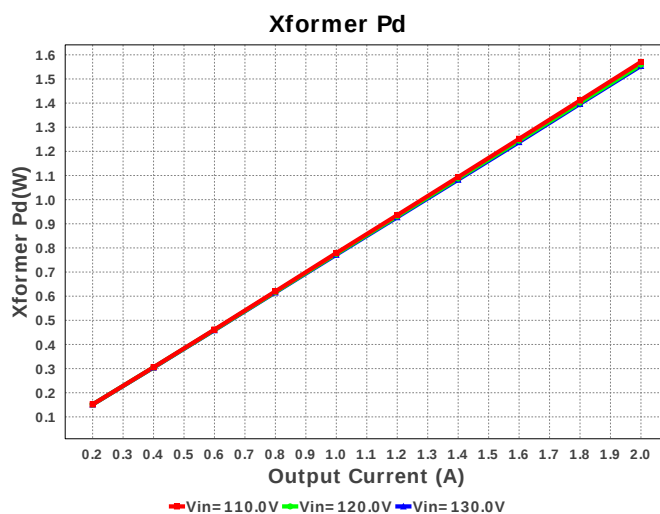
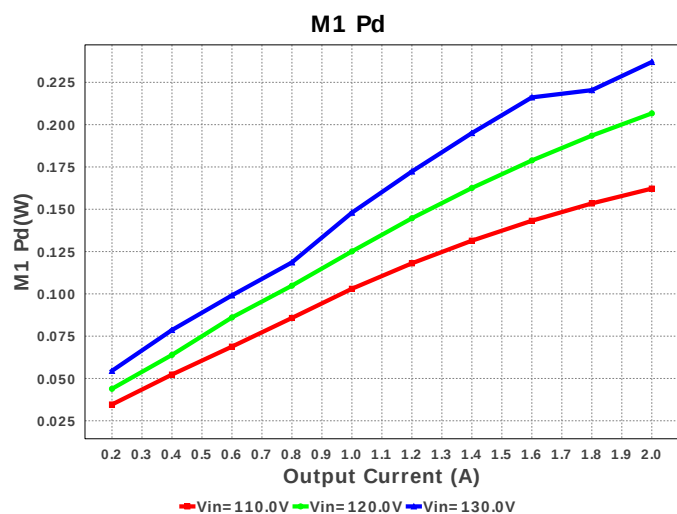
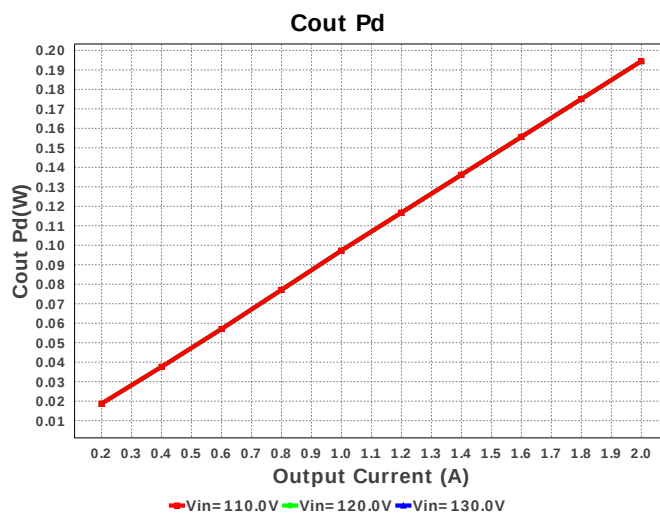
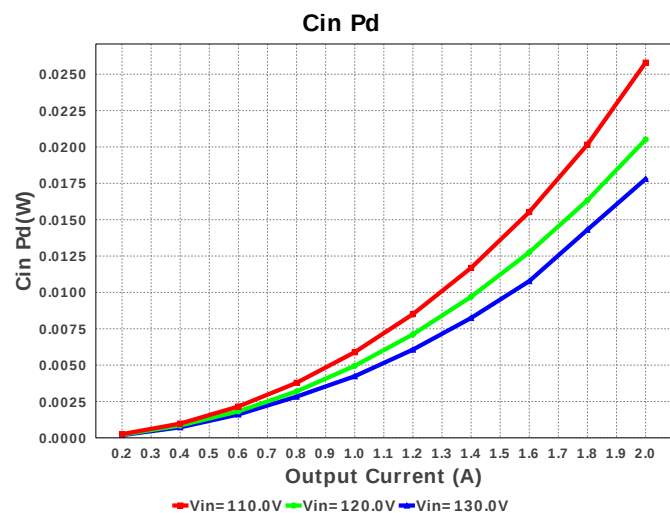


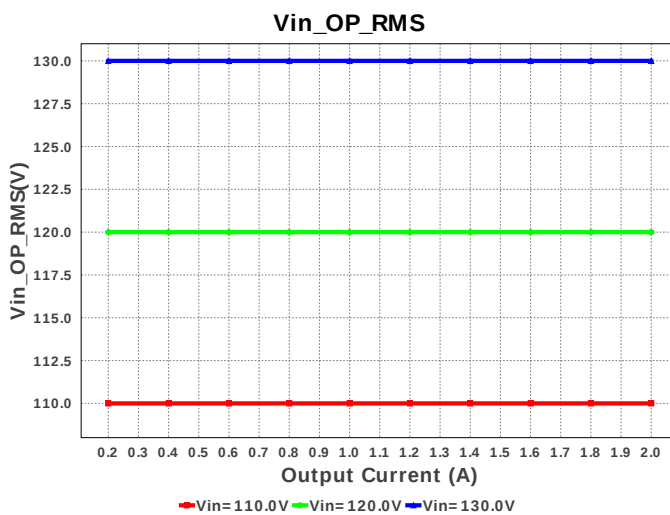
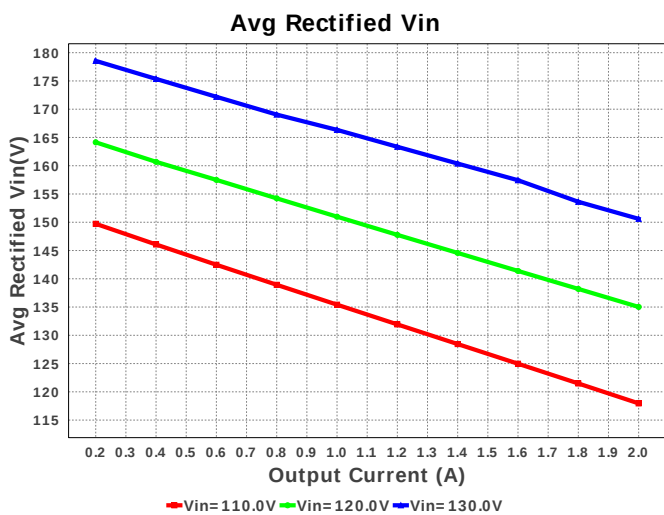
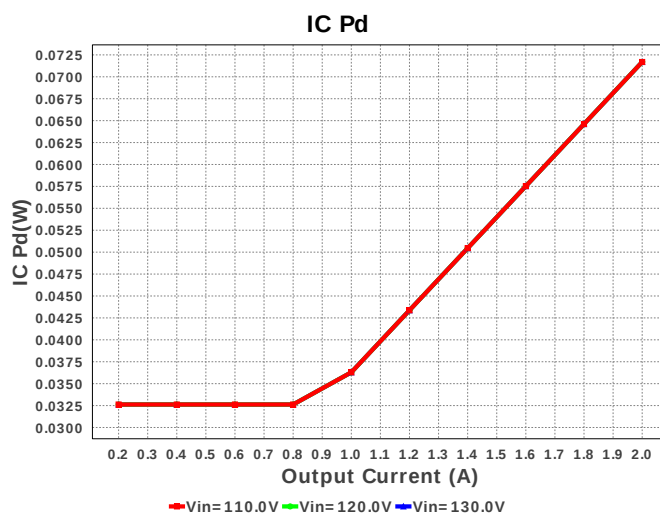
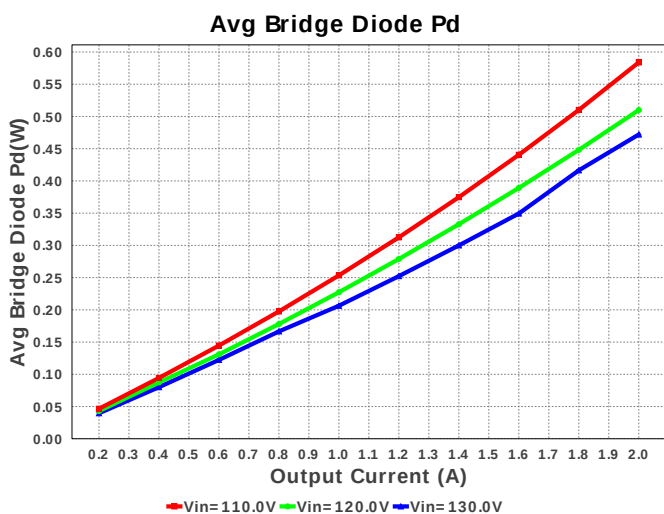
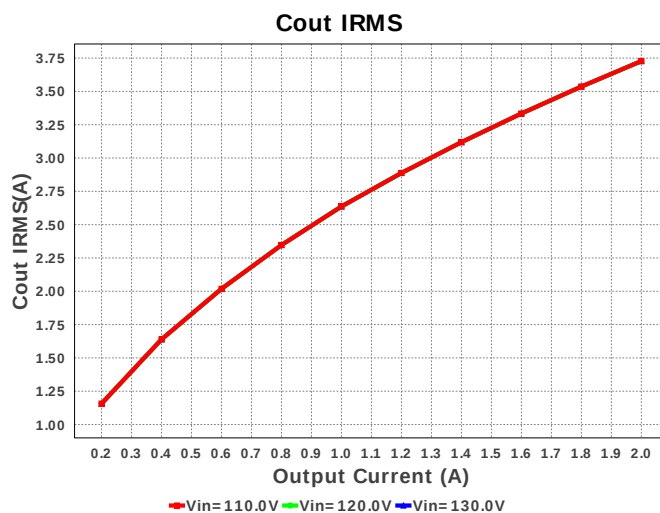
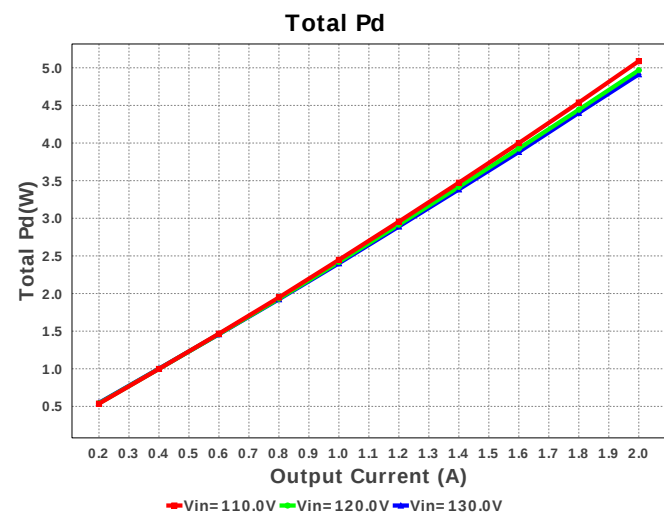
Zener Pd

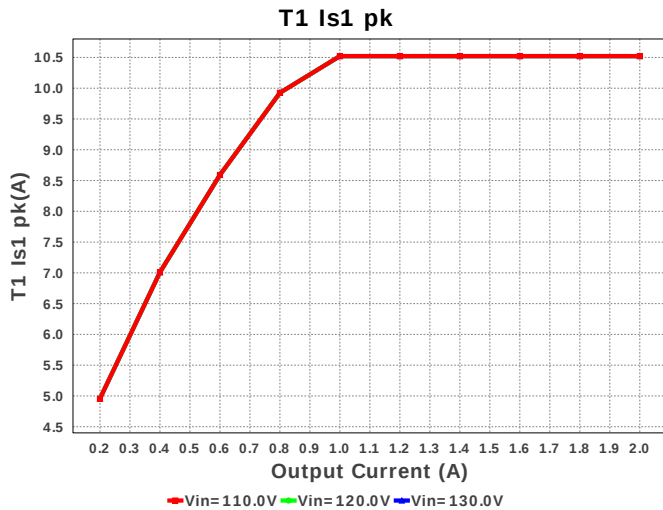


lin rms









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	230.336 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	644.545 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	3.741 A	Current	Output capacitor RMS ripple current
4.	Iin rms	264.03 mA	Current	RMS Input Current
5.	T1 Iprim RMS	467.119 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	1.516 A	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	3.76 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	10.599 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	152.367 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	33	General	Total Design BOM count
11.	FootPrint	1.147 k mm ²	General	Total Foot Print Area of BOM components
12.	Pout	30.0 W	General	Total output power
13.	Total BOM	\$0.0	General	Total BOM Cost
14.	Vout Actual	15.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	15.0 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	28.494 %	Op_point	Duty cycle
17.	Efficiency	87.401 %	Op_point	Steady state efficiency
18.	Frequency_	69.925 kHz	Op_point	Switching frequency
19.	IC Tj	39.943 degC	Op_point	IC junction temperature
20.	ICThetaJA	141.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	2.0 A	Op_point	Iout operating point
22.	M1 TJOP	42.648 degC	Op_point	M1 MOSFET junction temperature
23.	Min Rectified Vin	120.888 V	Op_point	Minimum voltage seen at rectified input
24.	Peak Rectified Vin	183.846 V	Op_point	Peak voltage seen at rectified input
25.	Vin_OP_RMS	130.0 V	Op_point	AC Input RMS Voltage
26.	Vout p-p	148.389 mV	Op_point	Peak-to-peak output ripple voltage
27.	Avg Bridge Diode Pd	330.394 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
28.	Cin Pd	16.817 mW	Power	Input capacitor power dissipation
29.	Cout Pd	195.944 mW	Power	Output capacitor power dissipation
30.	Diode2 Pd	821.552 mW	Power	Diode2 power dissipation
31.	IC Pd	70.27 mW	Power	IC power dissipation
32.	M1 Pd	252.96 mW	Power	M1 MOSFET total power dissipation
33.	Total Pd	4.324 W	Power	Total Power Dissipation
34.	Xformer Pd	1.548 W	Power	Transformer power dissipation
35.	Zener Pd	108.161 mW	Power	Zener power dissipation
36.	Vout Tolerance	2.009 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	130.0	Maximum input voltage
3.	VinMin	110.0	Minimum input voltage
4.	Vout	15.0	Output Voltage
5.	acFrequency	60.0	Light Output in Lumen
6.	base_pn	UCC28740	Texas Instruments Base Part Number
7.	source	AC	Input Source Type
8.	ta	30.0	Ambient temperature

Design Assistance

1. Application Hints 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. Rtl Rtl is added to prevent excessive diode current and limit lopt to the maximum value necessary for regulation. The Rtl value may be adjusted for optimal limiting later during the prototype evaluation process. Rfbt & 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. Rfb3 & Cfb3 Rfb3 is necessary to limit the current into FB and to avoid excess draining of Cvdd during this type of transient situation. The value of Rfb3 is chosen to limit the excess Ifb and Rfb4 current to an acceptable level when the optocoupler is saturated. Cfb3 helps improve the transient response and is estimated initially by equating the time constant to 1ms. This can later be adjusted for optimal performance during prototype evaluation. Rfb4 Rfb4 speeds up the turnoff time of the optocoupler in the case of a heavy load-step transient condition. This value tends to fall within the range of 10k and 100k. A tradeoff must be made between a lower value for faster transient response and a higher value for lower standby power. Rfb4 also serves to set a minimum bias current for the optocoupler and to drain dark current. Part Description The UCC28740 isolated-flyback controller provides Constant-Voltage (CV) using an optical coupler to improve transient response. Constant-Current (CC) regulation is accomplished through Primary Side Regulation (PSR) techniques. Please see the datasheet for further design guidance. <http://www.ti.com/lit/ds/symlink/ucc28740.pdf>

2. UCC28740 Product Folder : <http://www.ti.com/product/UCC28740> : contains the data sheet and other resources.

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