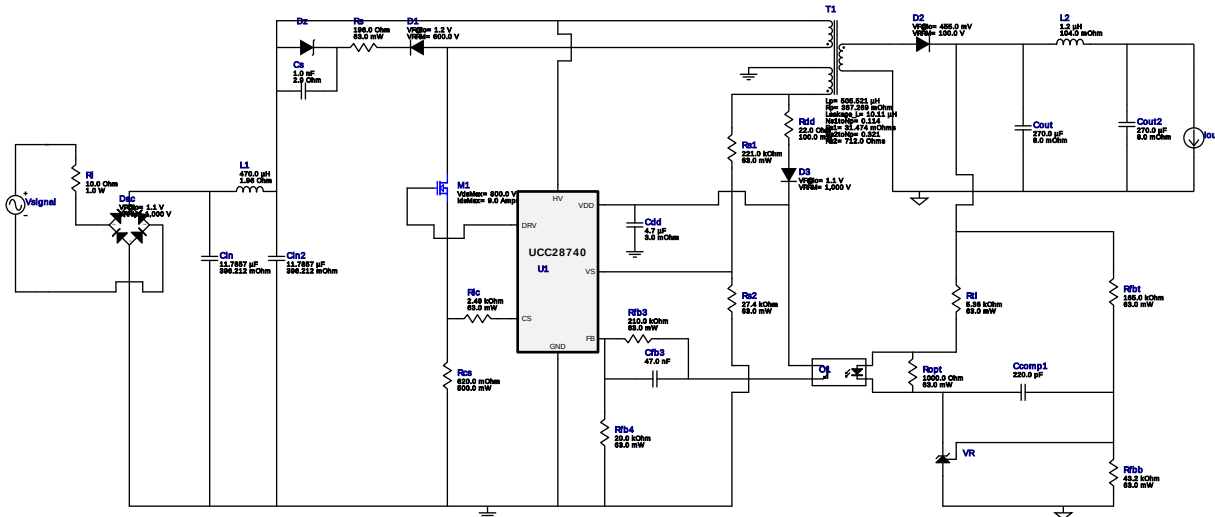


WEBENCH® Design Report

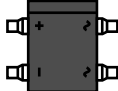
Design : 4737609/5 UCC28740DR
UCC28740DR 110.0V-240.0V to 12.00V @ 2.0A



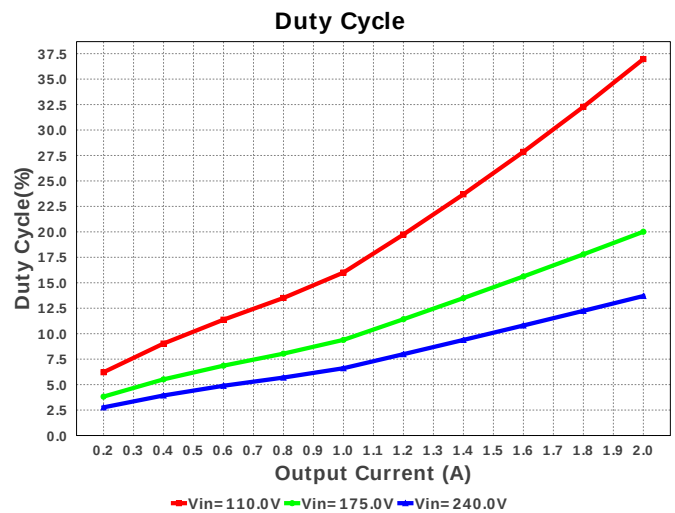
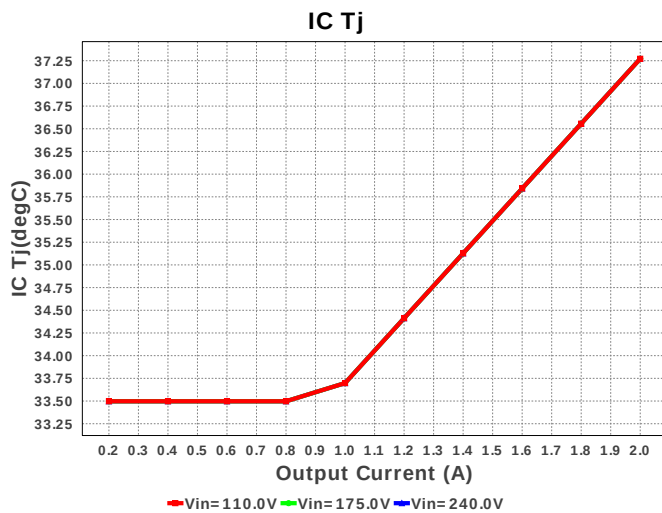
1. Rlc, Rtl and the feedback resistors for this design are a starting point, but may need adjustment based on the actual transformer used. For more information please click the design assistance button.

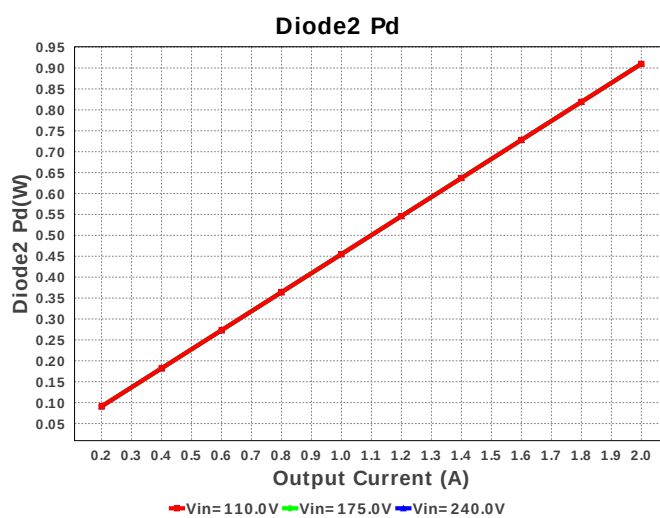
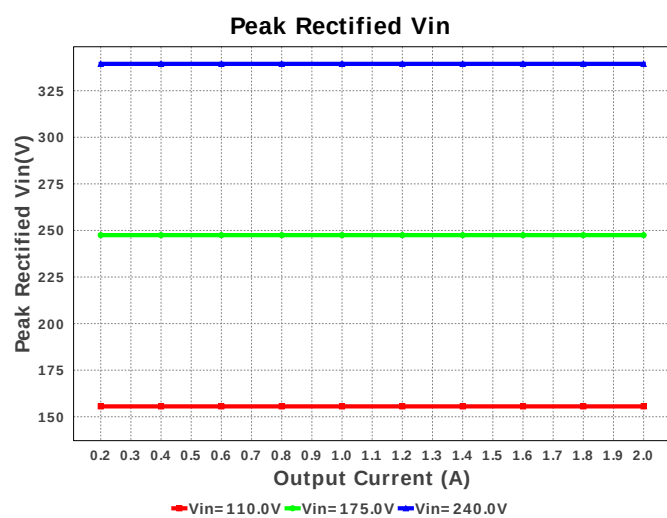
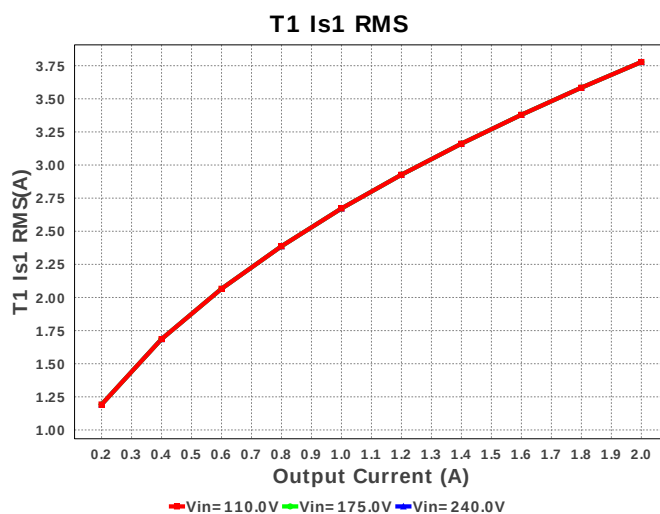
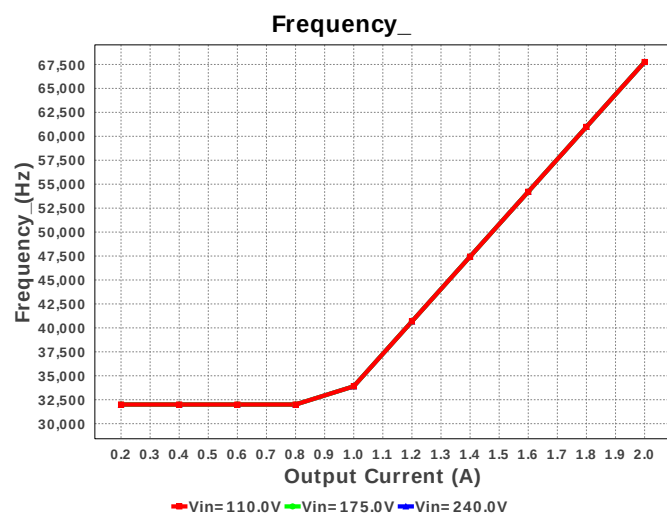
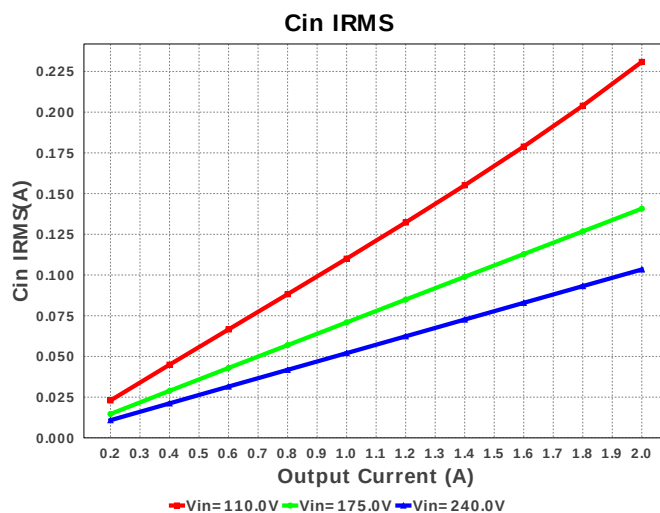
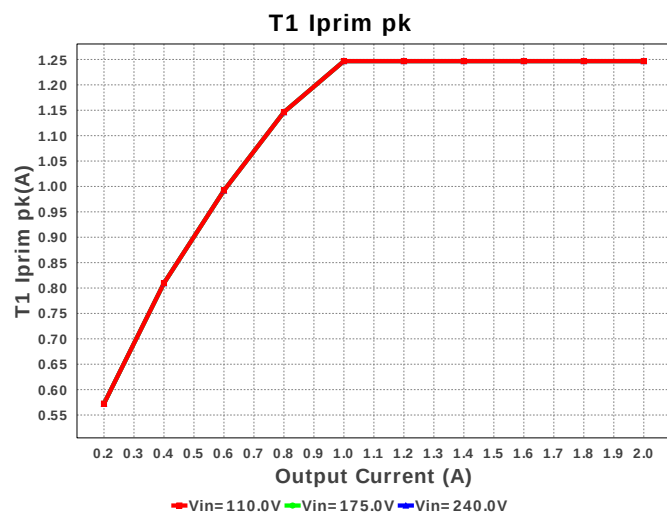
Electrical BOM

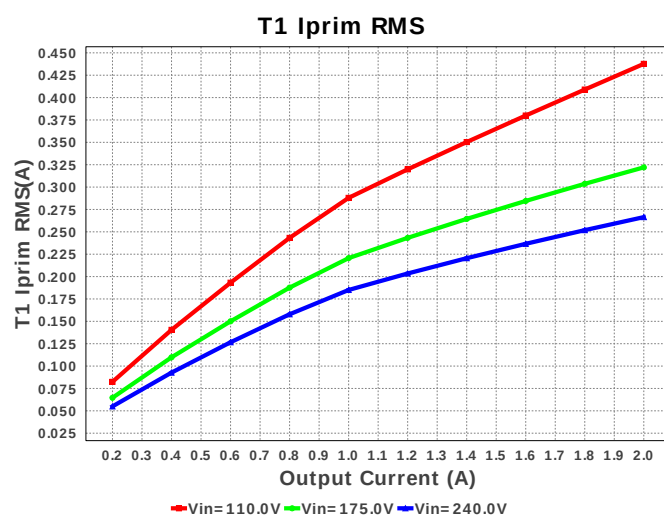
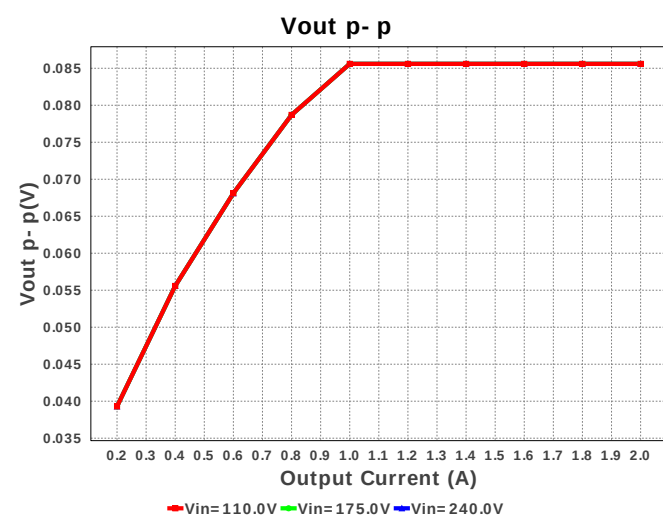
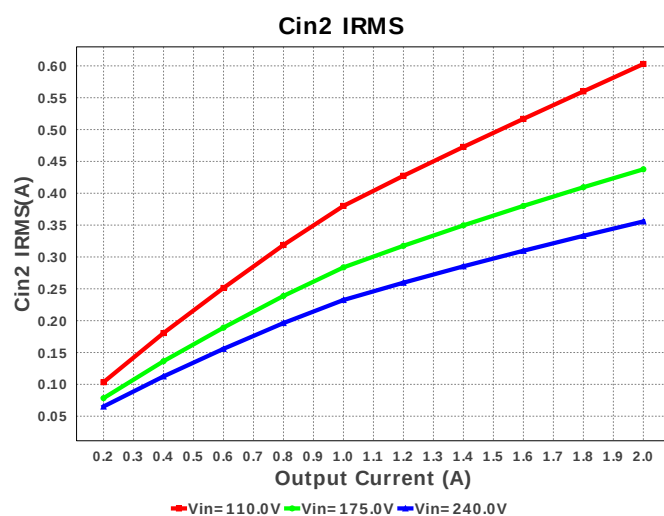
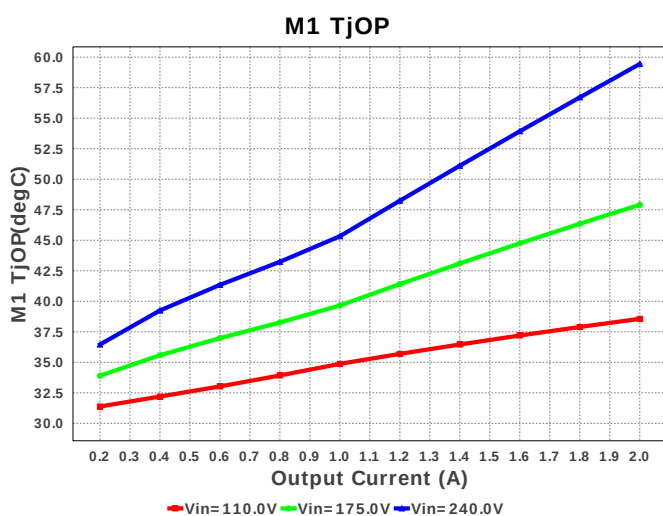
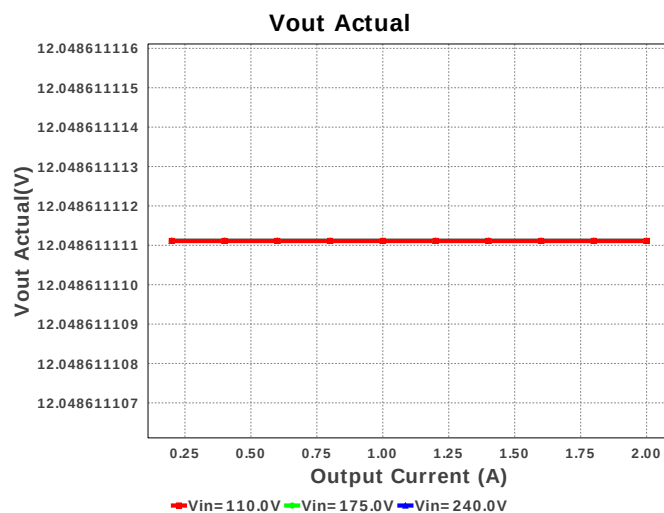
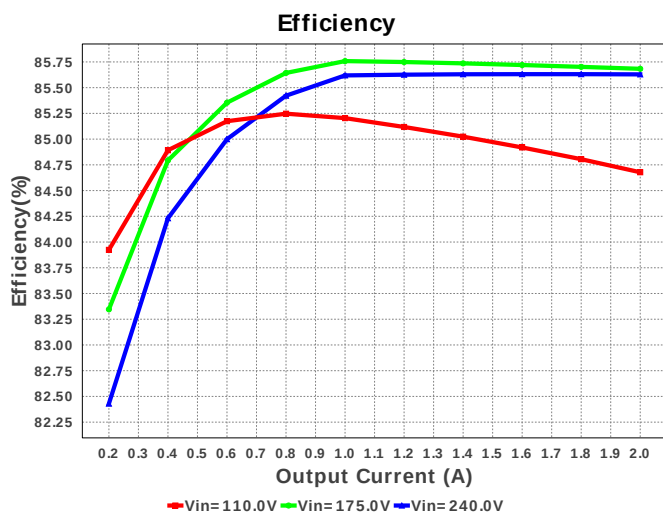
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp1	Yageo America	CC0805JRNPO9BN221 Series= C0G/NP0	Cap= 220.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
2.	Cdd	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	\$0.07	 1206 11 mm ²
3.	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= 11.7857 uF ESR= 396.21 mOhm VDC= 509.11 V IRMS= 339.642 mA	1	NA	CUSTOM 0 mm ²
5.	Cin2	CUSTOM	CUSTOM Series= ?	Cap= 11.7857 uF ESR= 396.21 mOhm VDC= 509.11 V IRMS= 339.642 mA	1	NA	CUSTOM 0 mm ²
6.	Cout	Panasonic	16SVPG270M Series= ?	Cap= 270.0 uF ESR= 8.0 mOhm VDC= 16.0 V IRMS= 5.8 A	1	\$0.70	 CAPSMT_62_C10 74 mm ²
7.	Cout2	Panasonic	16SVPG270M Series= ?	Cap= 270.0 uF ESR= 8.0 mOhm VDC= 16.0 V IRMS= 5.8 A	1	\$0.70	 CAPSMT_62_C10 74 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

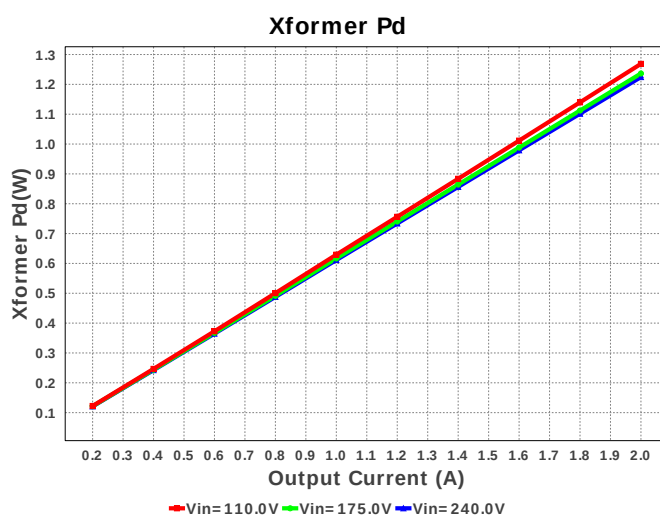
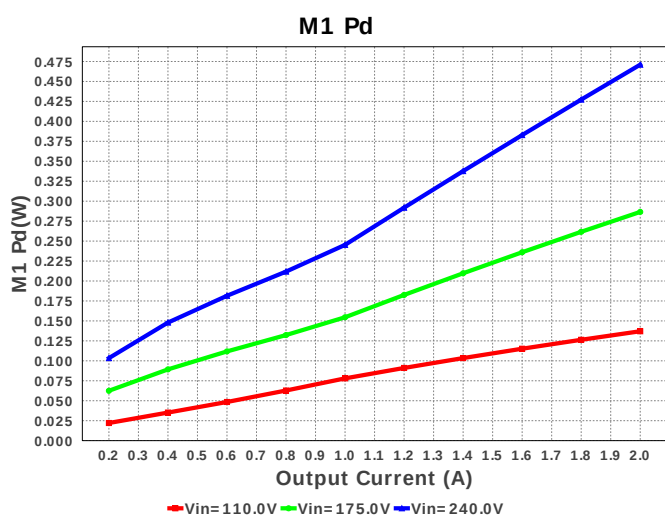
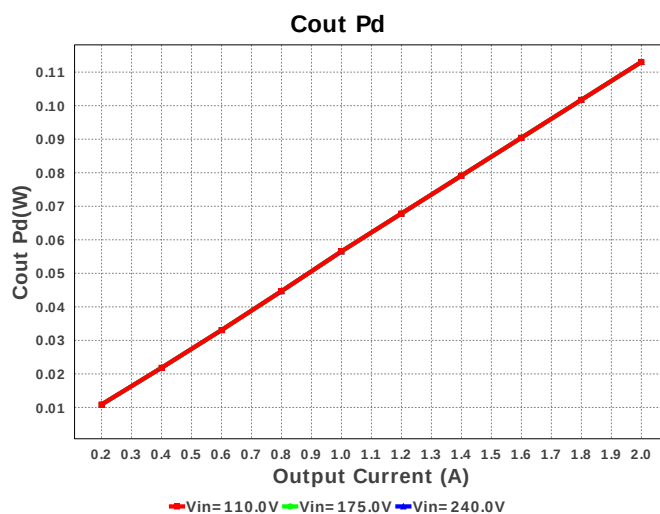
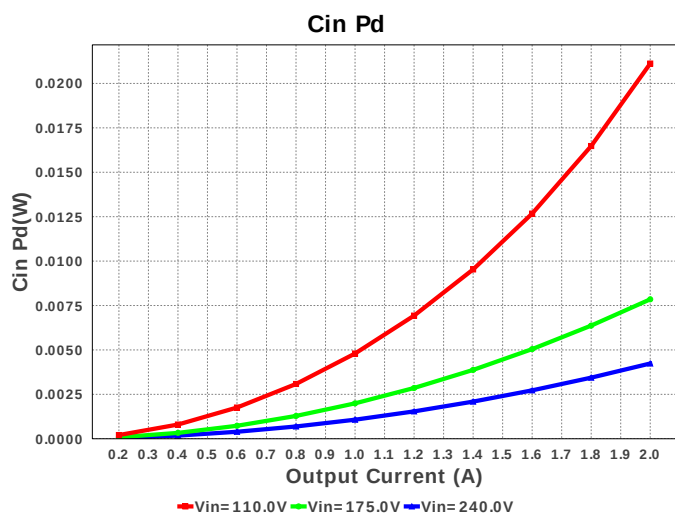
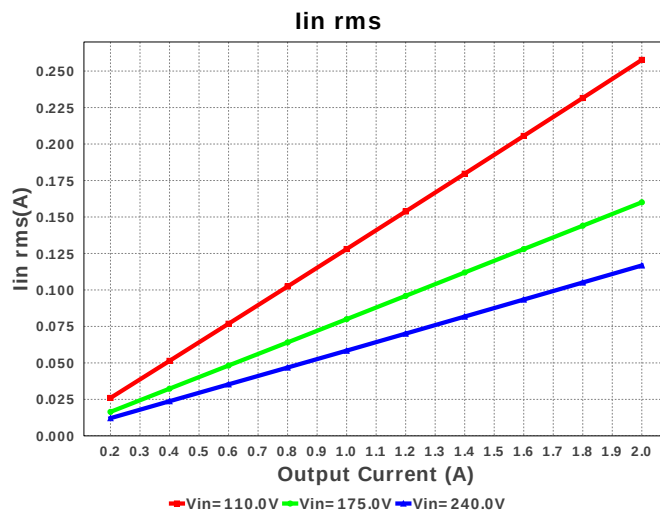
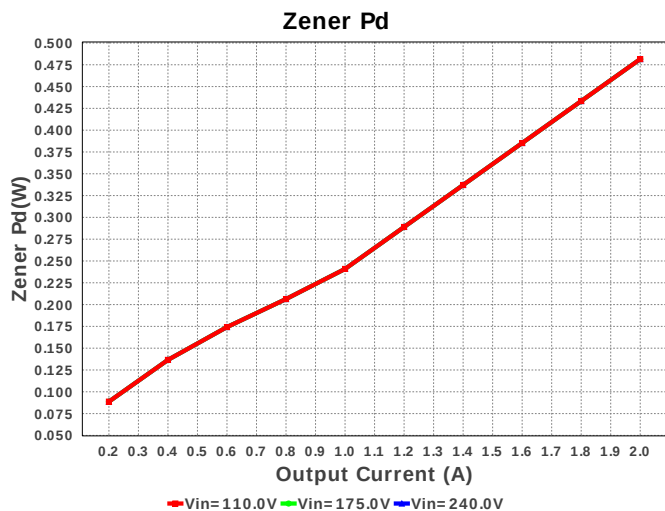
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	D1	Bourns	CD214B-F3600	VF@Io= 1.2 V VRRM= 600.0 V	1	\$0.14	 SMB 44 mm ²
10.	D2	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	\$1.33	 DDPAK 210 mm ²
11.	D3	Fairchild Semiconductor	1N4007	VF@Io= 1.1 V VRRM= 1,000.0 V	1	\$0.03	 DO-41 43 mm ²
12.	Dac	Vishay-Semiconductor	DF10SA	VF@Io= 1.1 V VRRM= 1,000.0 V	1	\$0.24	 DF-S 99 mm ²
13.	Dz	ON Semiconductor	1SMB5952BT3G	Zener	1	\$0.10	 SMB 44 mm ²
14.	L1	Bourns	SDR0805-471KL	L= 470.0 µH DCR= 1.96 Ohm	1	\$0.22	 SDR0805 96 mm ²
15.	L2	TDK	MLP2520S1R0ST0S1	L= 1.2 µH DCR= 104.0 mOhm	1	\$0.14	 MLP2520S-S 12 mm ²
16.	M1	STMicroelectronics	STF10N80K5	VdsMax= 800.0 V IdsMax= 9.0 Amps	1	\$2.52	 TO-220FP 79 mm ²
17.	O1	California Eastern Laboratories	PS2811-1	Optocoupler	1	\$0.38	 SSOP-4 111 mm ²
18.	Rcs	Rohm	MCR25JZHFLR620 Series= MCR25	Res= 620.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.03	 1210 15 mm ²
19.	Rdd	Yageo America	RC0603FR-0722RL Series= ?	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
20.	Rfb3	Vishay-Dale	CRCW0402210KFKED Series= CRCW..e3	Res= 210.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Rfb4	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	Rfbb	Vishay-Dale	CRCW040243K2FKED Series= CRCW..e3	Res= 43.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
23.	Rfbt	Vishay-Dale	CRCW0402165KFKED Series= CRCW..e3	Res= 165.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
24.	RI	Vishay-Dale	CRCW121810R0FKEK Series= CRCW..e3	Res= 10.0 Ohm Power= 1.0 W Tolerance= 1.0%	1	\$0.13	 1218 24 mm ²
25.	Rlc	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
26.	Ropt	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

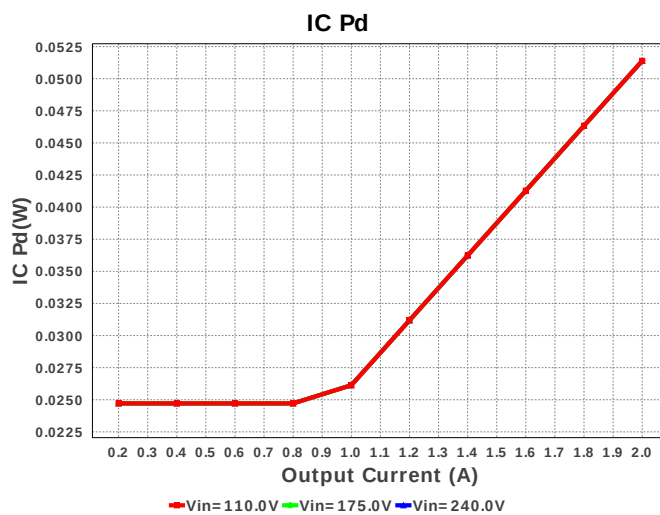
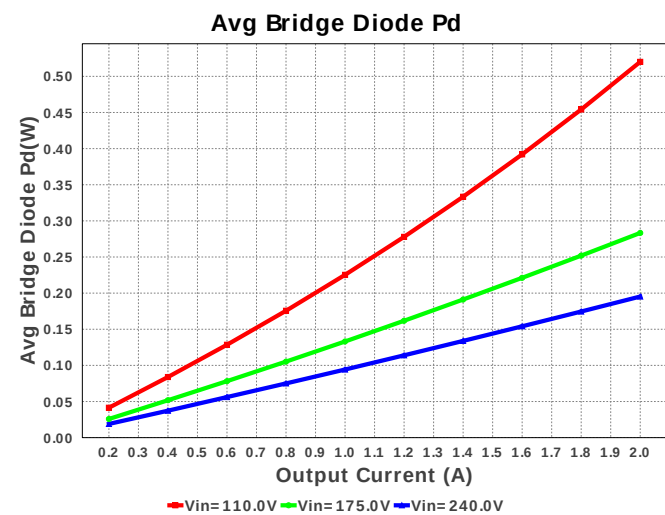
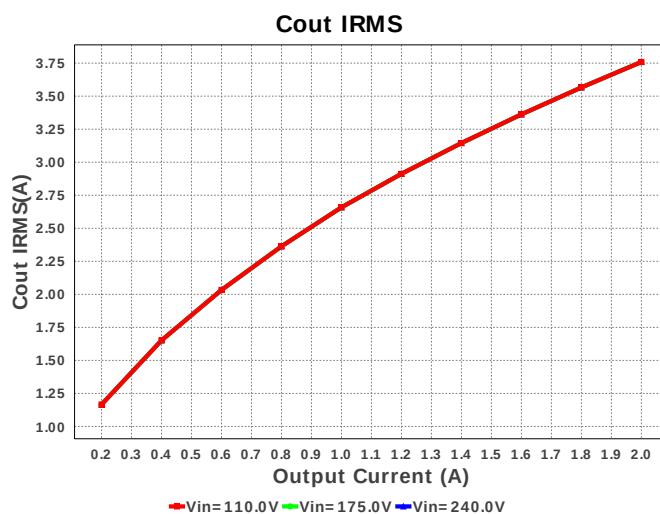
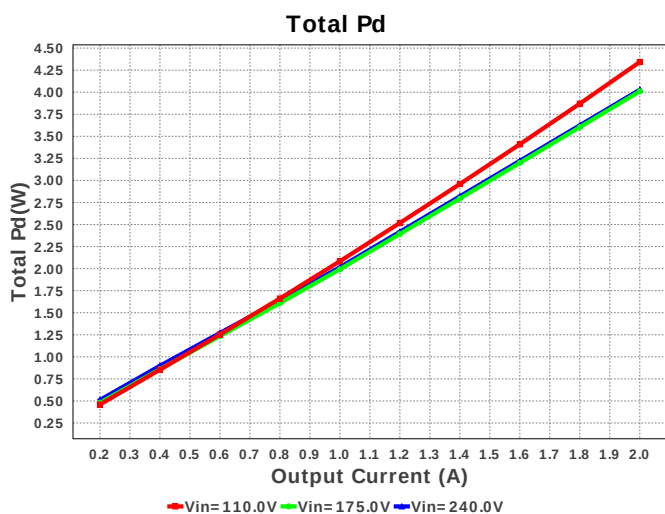
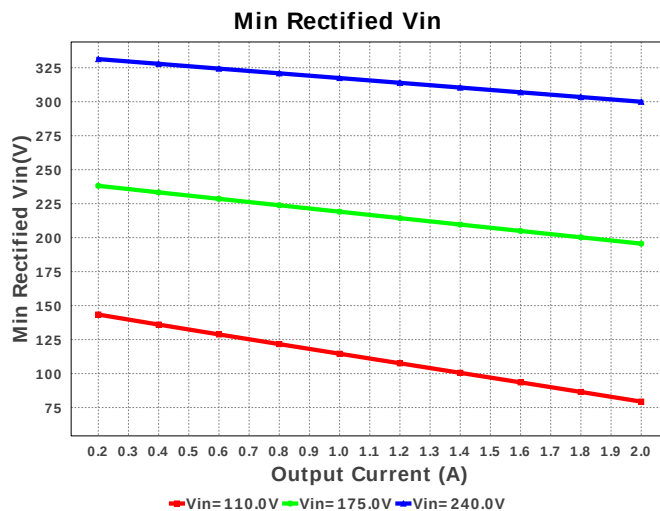
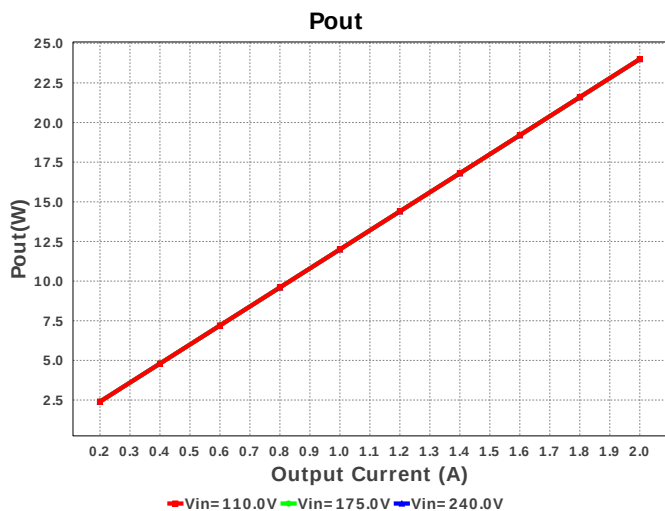
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	Rs	Vishay-Dale	CRCW0402196RFKED Series= CRCW..e3	Res= 196.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
28.	Rs1	Vishay-Dale	CRCW0402221KFKED Series= CRCW..e3	Res= 221.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
29.	Rs2	Vishay-Dale	CRCW040227K4FKED Series= CRCW..e3	Res= 27.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
30.	Rtl	Vishay-Dale	CRCW04025K36FKED Series= CRCW..e3	Res= 5.36 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
31.	T1	CUSTOM	CUSTOM	Lp= 505.521 µH Rp= 367.269 mOhm Leakage_L= 10.11 µH Ns1toNp= 0.114 Rs1= 31.474 mOhms Ns2toNp= 0.321 Rs2= 712.0 Ohms	1	NA	CUSTOM 0 mm ²
32.	U1	Texas Instruments	UCC28740DR	Switcher	1	\$0.42	 R-PDSO-G7 55 mm ²
33.	VR	Texas Instruments	TL431AIDBZR	Voltage References	1	\$0.08	 DBZ0003A 14 mm ²

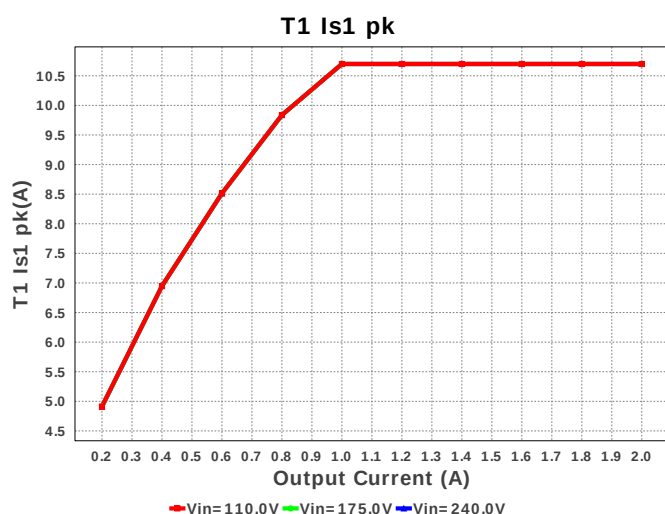
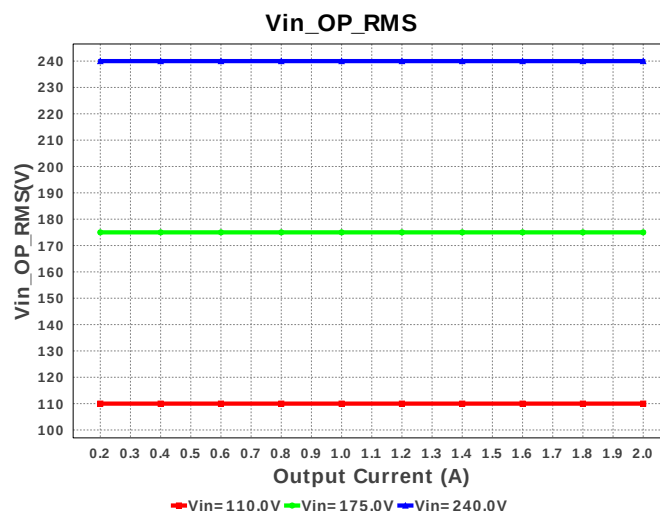
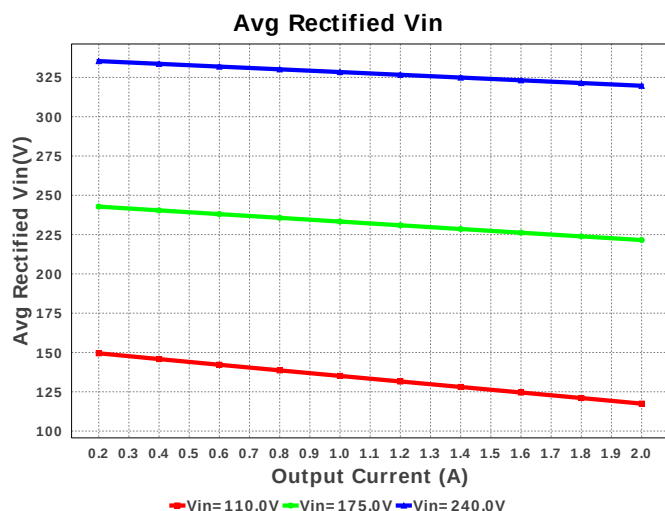












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	101.754 mA	Current	Input capacitor RMS ripple current
2.	Cin2 IRMS	351.639 mA	Current	Input Capacitor Cin2 RMS Ripple Current
3.	Cout IRMS	3.773 A	Current	Output capacitor RMS ripple current
4.	Iin rms	113.8 mA	Current	RMS Input Current
5.	T1 Iprim RMS	263.472 mA	Current	Transformer Primary RMS Current
6.	T1 Iprim pk	1.247 A	Current	Transformer Primary Peak Current
7.	T1 Is1 RMS	3.792 A	Current	Transformer Secondary1 RMS Current
8.	T1 Is1 pk	10.778 A	Current	Transformer Secondary1 Peak Current
9.	Avg Rectified Vin	321.445 V	General	Average Rectified Voltage for the AC Line Period
10.	BOM Count	33	General	Total Design BOM count
11.	FootPrint	1.13 k mm ²	General	Total Foot Print Area of BOM components
12.	Pout	24.0 W	General	Total output power
13.	Total BOM	\$0.0	General	Total BOM Cost
14.	Vout Actual	12.049 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	13.397 %	Op_point	Duty cycle
17.	Efficiency	87.877 %	Op_point	Steady state efficiency
18.	Frequency	66.683 kHz	Op_point	Switching frequency
19.	IC Tj	37.158 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	59.222 degC	Op_point	M1 MOSFET junction temperature
23.	Min Rectified Vin	303.482 V	Op_point	Minimum voltage seen at rectified input
24.	Peak Rectified Vin	339.408 V	Op_point	Peak voltage seen at rectified input
25.	Vin_OP_RMS	240.0 V	Op_point	AC Input RMS Voltage
26.	Vout p-p	86.226 mV	Op_point	Peak-to-peak output ripple voltage
27.	Avg Bridge Diode Pd	130.209 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
28.	Cin Pd	4.102 mW	Power	Input capacitor power dissipation
29.	Cout Pd	113.859 mW	Power	Output capacitor power dissipation
30.	Diode2 Pd	874.277 mW	Power	Diode2 power dissipation
31.	IC Pd	50.587 mW	Power	IC power dissipation

#	Name	Value	Category	Description
32.	M1 Pd	467.558 mW	Power	M1 MOSFET total power dissipation
33.	Total Pd	3.311 W	Power	Total Power Dissipation
34.	Xformer Pd	1.226 W	Power	Transformer power dissipation
35.	Zener Pd	130.168 mW	Power	Zener power dissipation
36.	Vout Tolerance	1.926 %		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	240.0	Maximum input voltage
3.	VinMin	110.0	Minimum input voltage
4.	Vout	12.0	Output Voltage
5.	line_fsw	60.0	Light Output in Lumen
6.	base_pn	UCC28740	Base Product 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 Iopt 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 Cvd 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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You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.

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