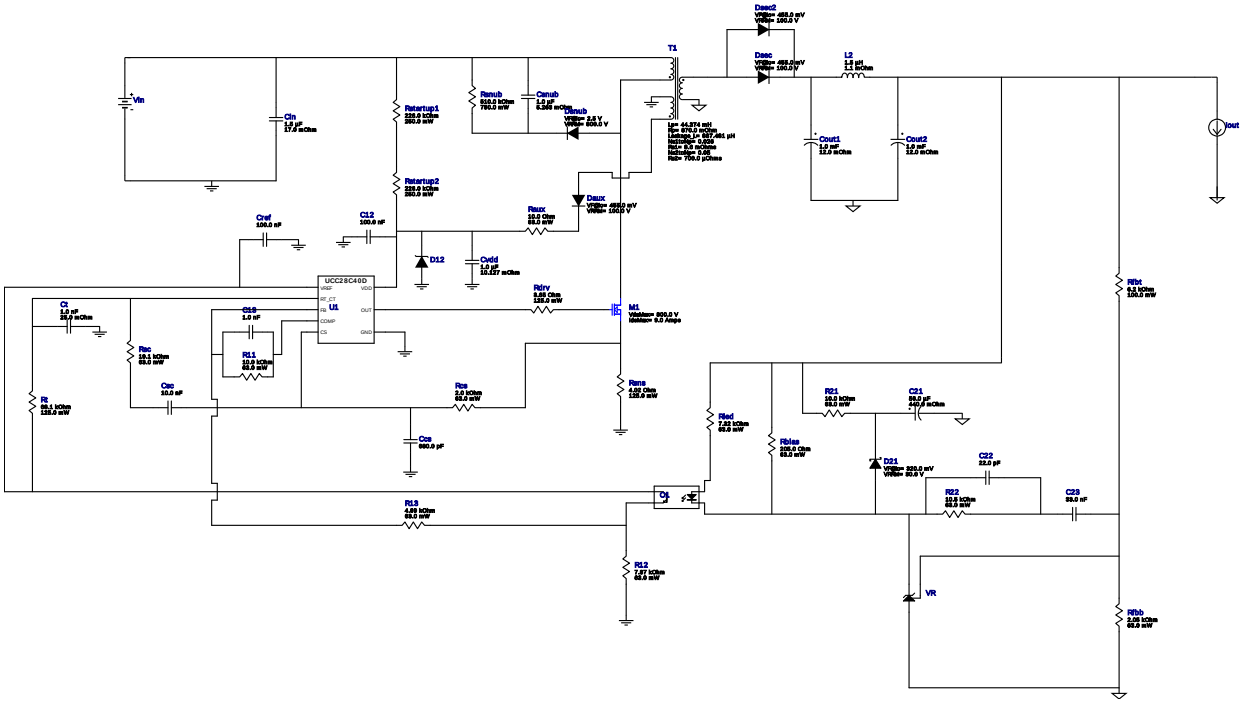
WEBENCH® Design Report

VinMin = 150.0V
VinMax = 280.0V
Vout = 5.0V
Iout = 2.0A

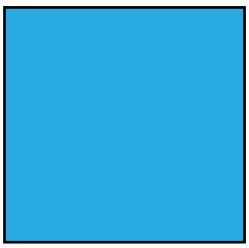
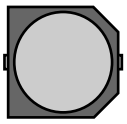
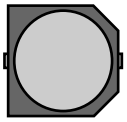
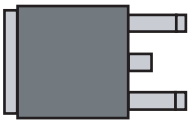
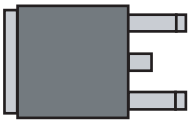
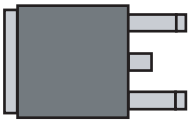
Device = UCC28C40DR
Topology = Flyback
Created = 7/12/16 12:13:59 AM
BOM Cost = $0.00
BOM Count = 44
Total Pd = 0.0W

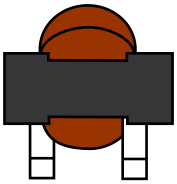
Design : 4354914/20 UCC28C40DR
UCC28C40DR 150.0V-280.0V to 5.00V @ 2.0A



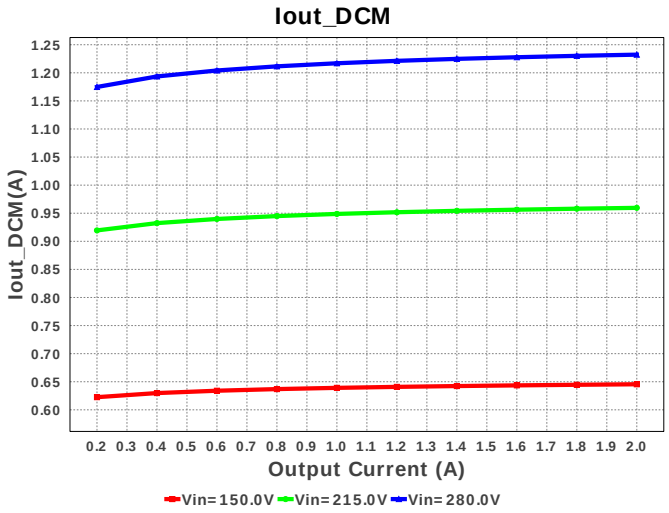
Electrical BOM

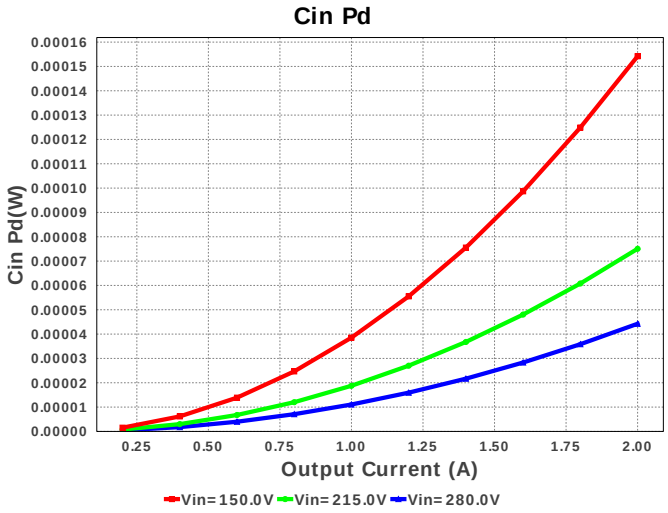
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C12	MuRata	GRM155R61C104KA88D Series= X5R	Cap= 100.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	C13	MuRata	GRM033R71C102KA01D Series= X7R	Cap= 1.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
3.	C21	Nichicon	UUD1A560MCL1GS Series= uD	Cap= 56.0 uF ESR= 440.0 mOhm VDC= 10.0 V IRMS= 230.0 mA	1	$0.11	SM_RADIAL_6.3AMM 80 mm²
4.	C22	Kemet	C0805C220K3GACTU Series= C0G/NP0	Cap= 22.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	C23	MuRata	GRM033R60J333KE01D Series= X5R	Cap= 33.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
6.	Ccs	MuRata	GRM033R71C681KA01D Series= X7R	Cap= 680.0 pF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²

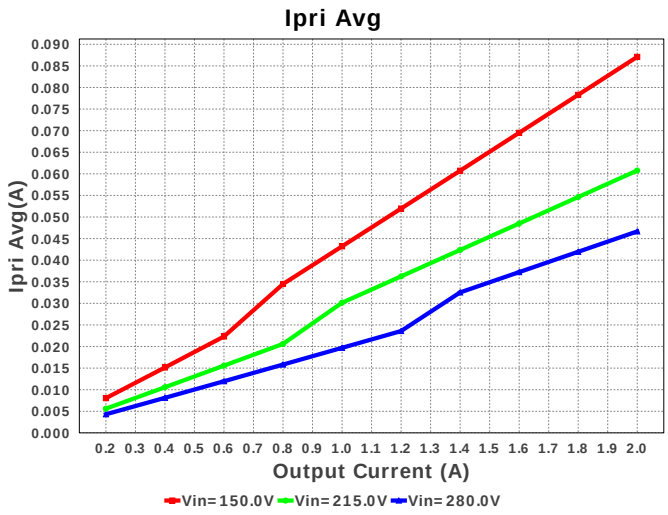
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cin	TDK	B32923C3155M Series= B32923	Cap= 1.5 uF ESR= 17.0 mOhm VDC= 630.0 V IRMS= 146.0 mA	1	$0.19	 B32923_22mm 399 mm^2
8.	Cout1	Panasonic	16SVPF1000M Series= ?	Cap= 1.0 mF ESR= 12.0 mOhm VDC= 16.0 V IRMS= 5.4 A	1	$0.74	 CAPSMT_62_F12 151 mm^2
9.	Cout2	Panasonic	16SVPF1000M Series= ?	Cap= 1.0 mF ESR= 12.0 mOhm VDC= 16.0 V IRMS= 5.4 A	1	$0.74	 CAPSMT_62_F12 151 mm^2
10.	Cref	MuRata	GRM155R61C104KA88D Series= X5R	Cap= 100.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm^2
11.	Csc	MuRata	GRM033R60J103KA01D Series= X5R	Cap= 10.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	 0201 2 mm^2
12.	Csnub	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	$1.19	 2220 54 mm^2
13.	Ct	Kemet	C0805C102J5GACTU Series= C0G/NP0	Cap= 1.0 nF ESR= 25.0 mOhm VDC= 50.0 V IRMS= 1.71 A	1	$0.01	 0805 7 mm^2
14.	Cvdd	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	$0.01	 0603 5 mm^2
15.	D12	Diodes Inc.	DFLZ18-7	Zener	1	$0.13	 PowerDI123 13 mm^2
16.	D21	Toshiba	CMS06	VF@Io= 320.0 mV VRRM= 30.0 V	1	$0.19	 M-FLAT 19 mm^2
17.	Daux	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.33	 DDPAK 210 mm^2
18.	Dsec	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.33	 DDPAK 210 mm^2
19.	Dsec2	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.33	 DDPAK 210 mm^2
20.	Dsnub	Bourns	CD1408-FU1800	VF@Io= 2.5 V VRRM= 800.0 V	1	$0.13	 Diode_1408 13 mm^2

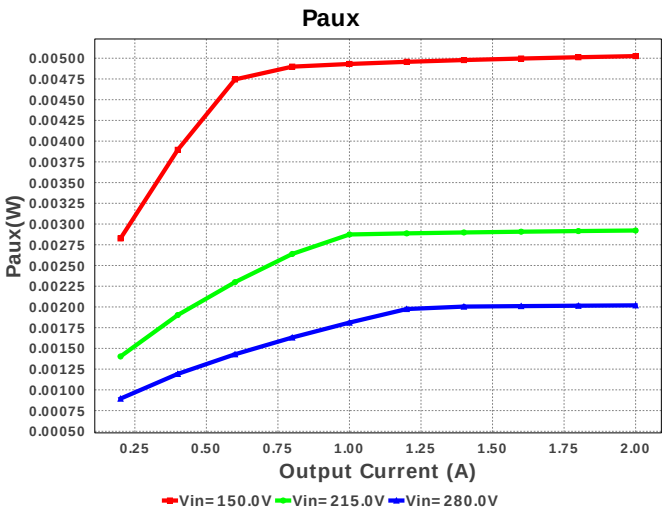
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
21.	L2	Coilcraft	SER1590-152MLB	L= 1.5 µH DCR= 1.1 mOhm	1	$1.12	 SER1590 324 mm^2
22.	M1	STMicroelectronics	STF10N80K5	VdsMax= 800.0 V IdsMax= 9.0 Amps	1	$2.52	 TO-220FP 79 mm^2
23.	O1	Vishay-Semiconductor	TCMT1109	Optocoupler	1	$0.21	 SOP-4 44 mm^2
24.	R11	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
25.	R12	Vishay-Dale	CRCW04027K87FKED Series= CRCW..e3	Res= 7.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
26.	R13	Vishay-Dale	CRCW04024K99FKED Series= CRCW..e3	Res= 4.99 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
27.	R21	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
28.	R22	Vishay-Dale	CRCW040210K5FKED Series= CRCW..e3	Res= 10.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
29.	Raux	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
30.	Rbias	Vishay-Dale	CRCW0402205RFKED Series= CRCW..e3	Res= 205.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
31.	Rcs	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
32.	Rdrv	Vishay-Dale	CRCW08053R65FKEA Series= CRCW..e3	Res= 3.65 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
33.	Rfbb	Vishay-Dale	CRCW04022K05FKED Series= CRCW..e3	Res= 2.05 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
34.	Rfbt	Yageo America	RC0603FR-076K2L Series= ?	Res= 6.2 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
35.	Rled	Vishay-Dale	CRCW04027K32FKED Series= CRCW..e3	Res= 7.32 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
36.	Rsc	Vishay-Dale	CRCW040219K1FKED Series= CRCW..e3	Res= 19.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
37.	Rsns	Vishay-Dale	CRCW08054R02FKEA Series= CRCW..e3	Res= 4.02 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
38.	Rsnub	Vishay-Dale	CRCW2010510KFKEF Series= ?	Res= 510.0 kOhm Power= 750.0 mW Tolerance= 1.0%	1	$0.03	 2010 32 mm^2
39.	Rstartup1	Panasonic	ERJ-8ENF2263V Series= ERJ-8E	Res= 226.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2

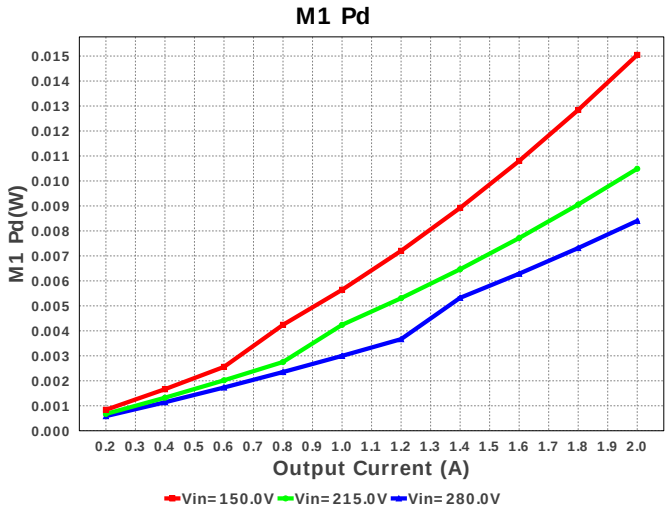
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
40.	Rstartup2	Panasonic	ERJ-8ENF2263V Series= ERJ-8E	Res= 226.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	 1206 11 mm^2
41.	Rt	Panasonic	ERJ-6ENF6812V Series= ERJ-6E	Res= 68.1 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
42.	T1	CUSTOM	CUSTOM	Lp= 44.374 mH Rp= 870.0 mOhm Leakage_L= 887.481 µH Ns1toNp= 0.026 Rs1= 8.6 mOhms Ns2toNp= 0.05 Rs2= 700.0 µOhms	1	NA	CUSTOM 0 mm^2
43.	U1	Texas Instruments	UCC28C40DR	Switcher	1	$0.75	 D0008A 57 mm^2
44.	VR	Texas Instruments	LMV431CM5/NOPB	Voltage References	1	$0.16	 R-PDSO-G3 16 mm^2

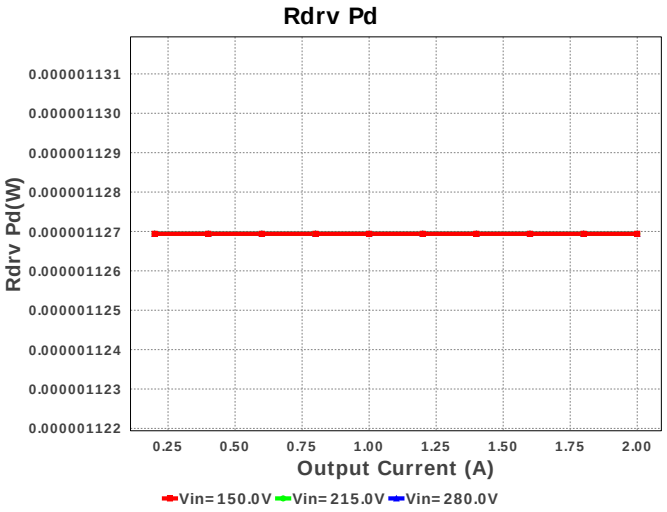


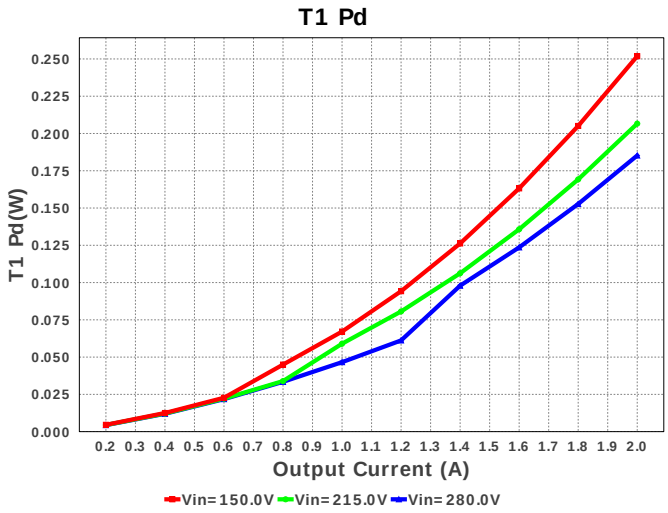


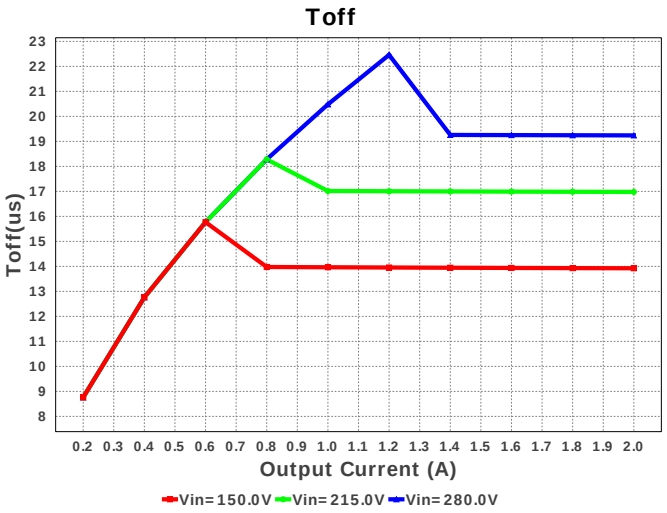


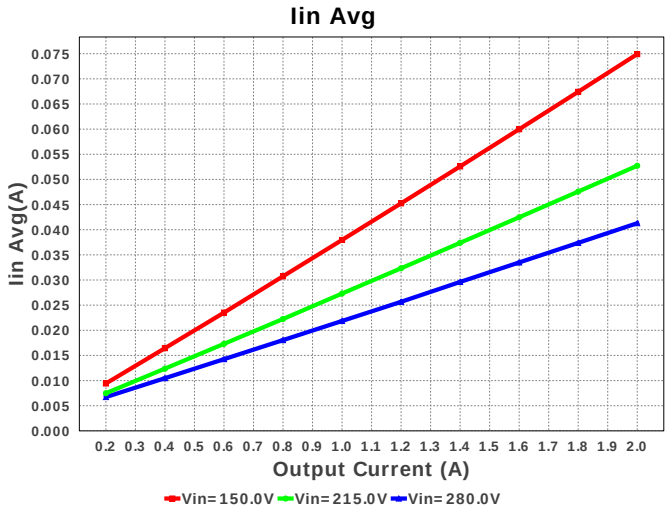


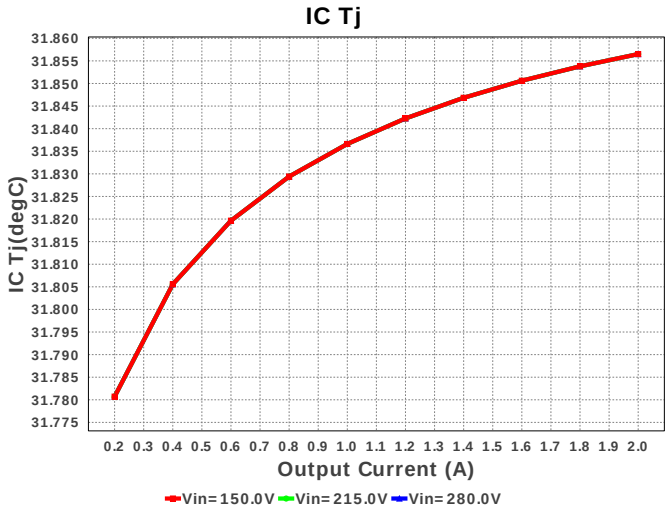


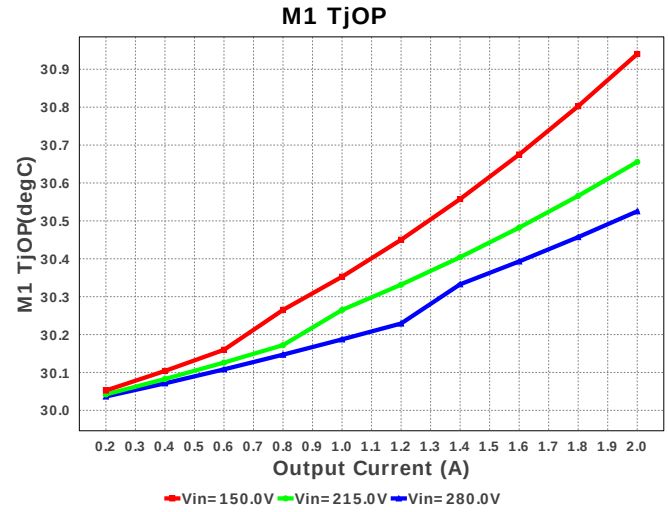


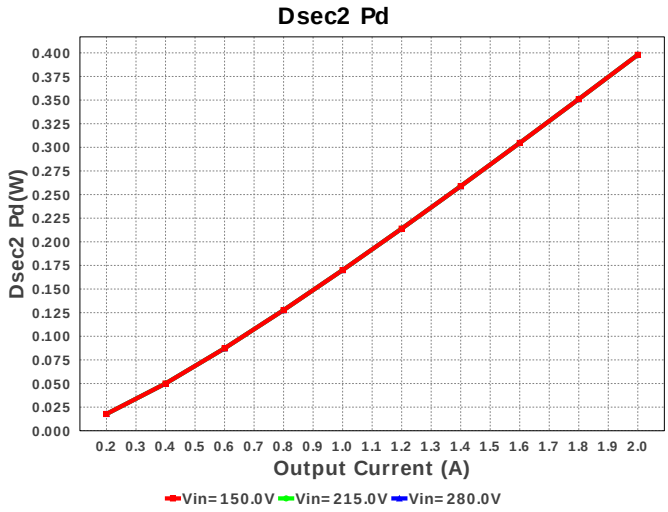


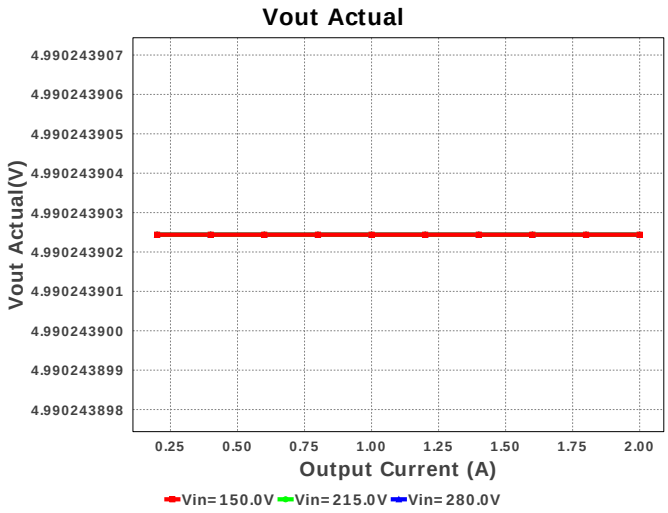


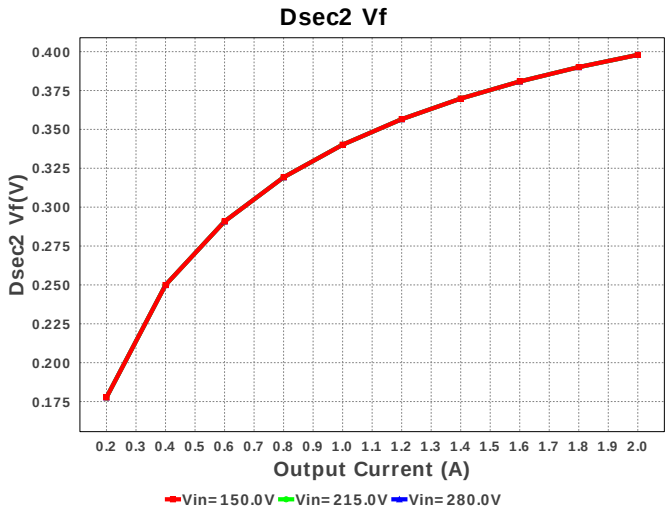


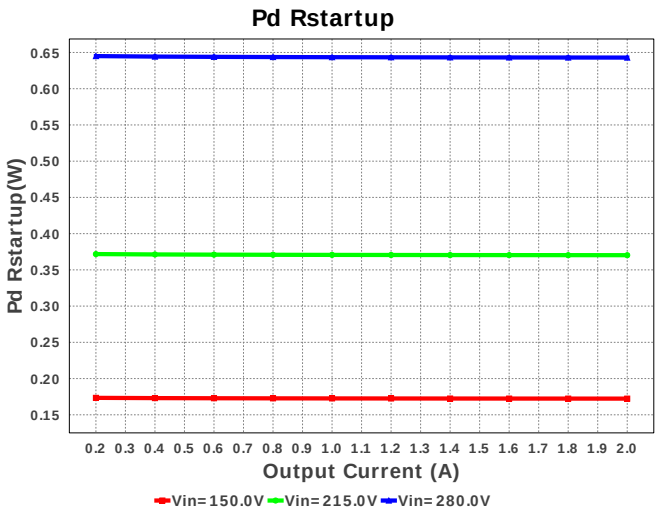


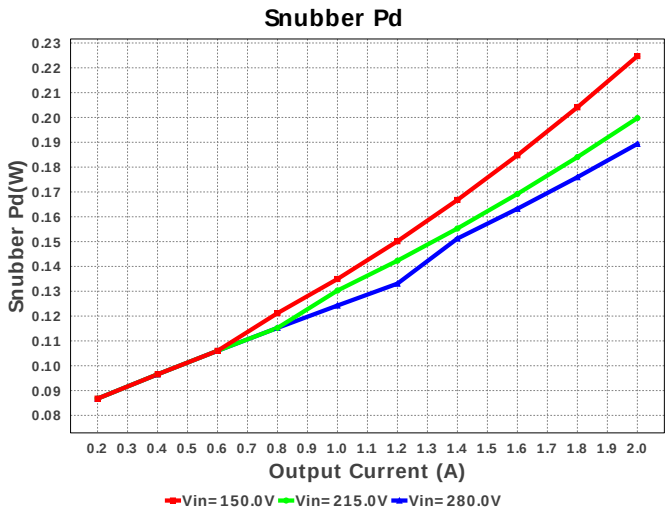


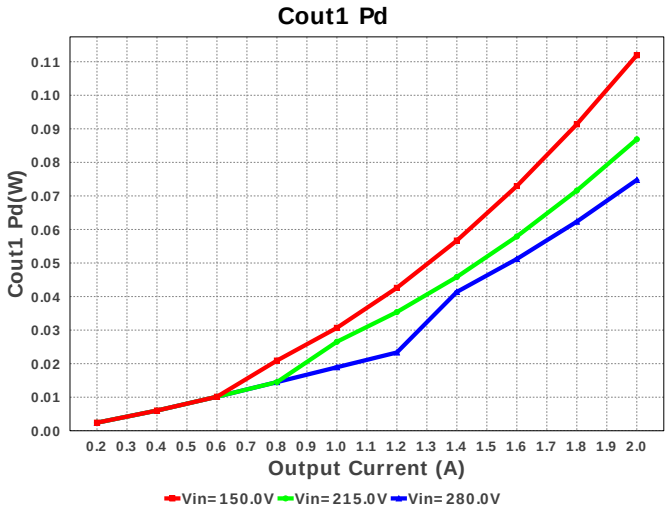


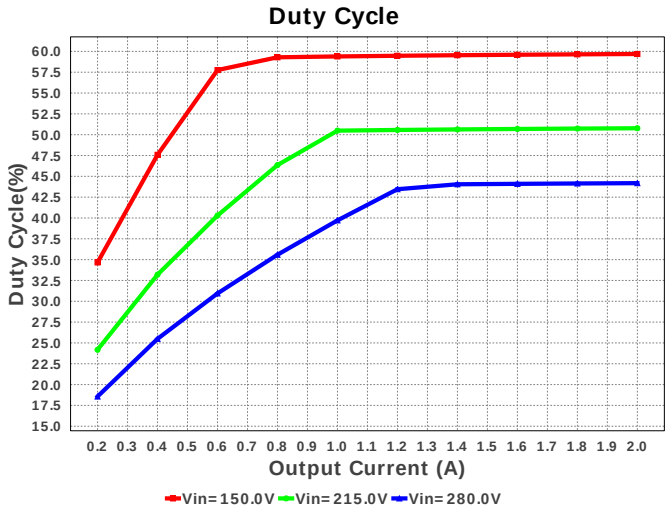


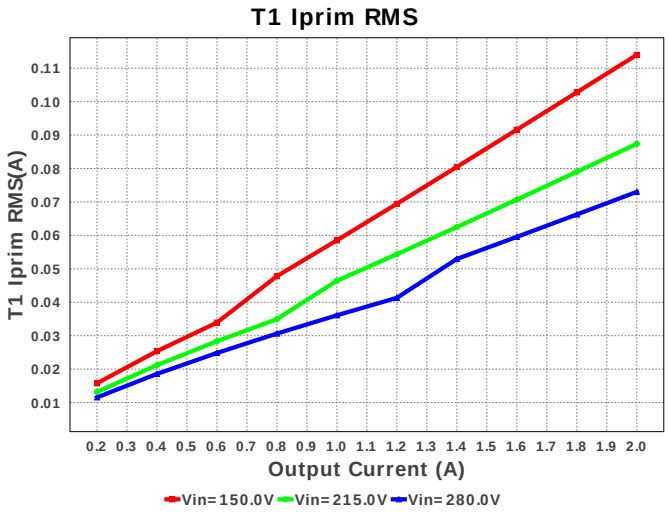


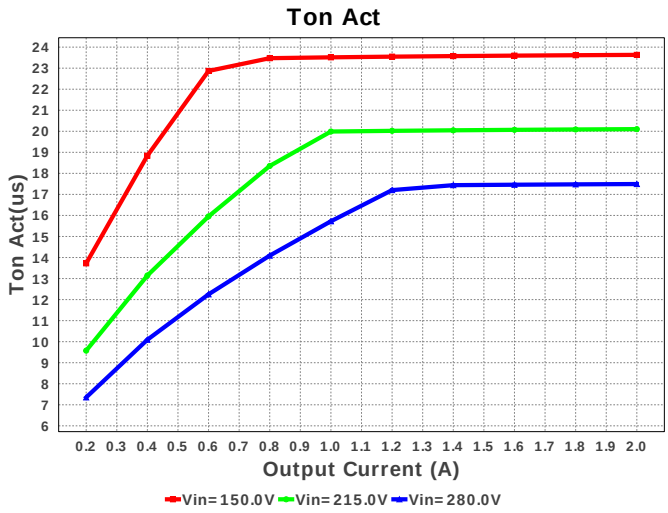


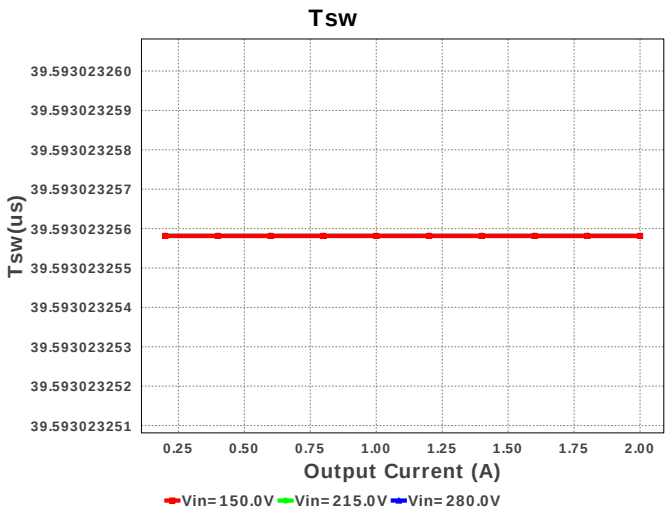


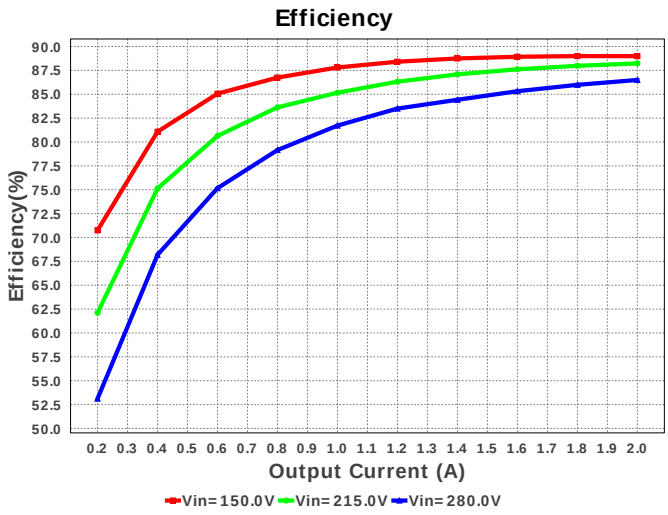


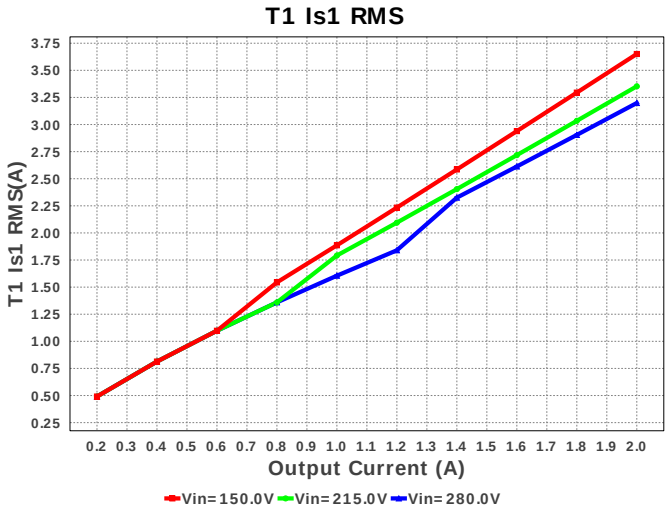


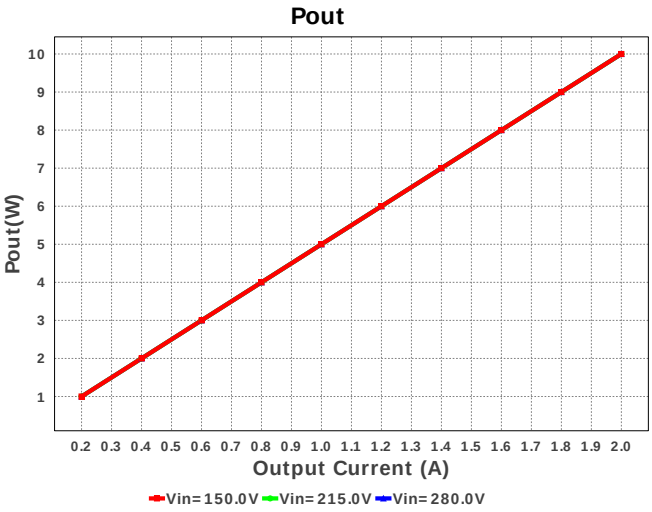


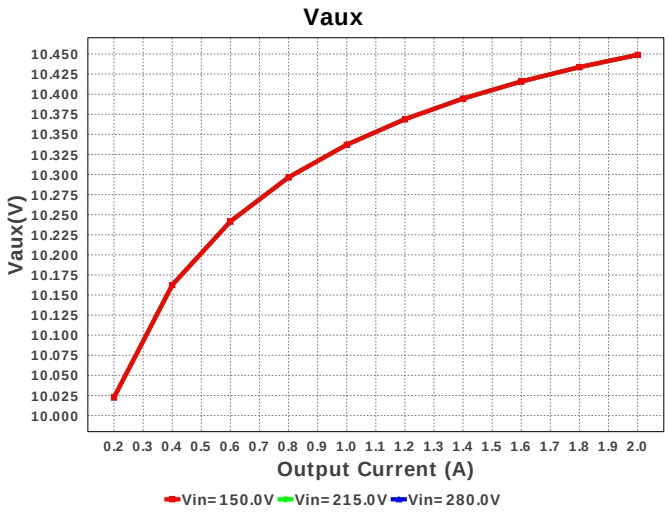


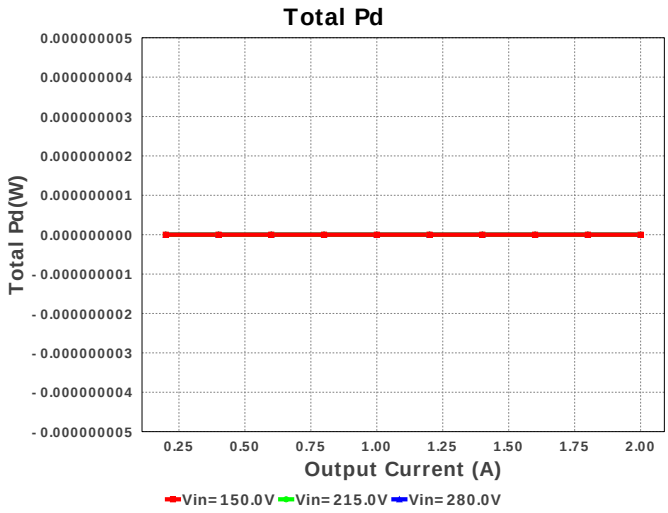


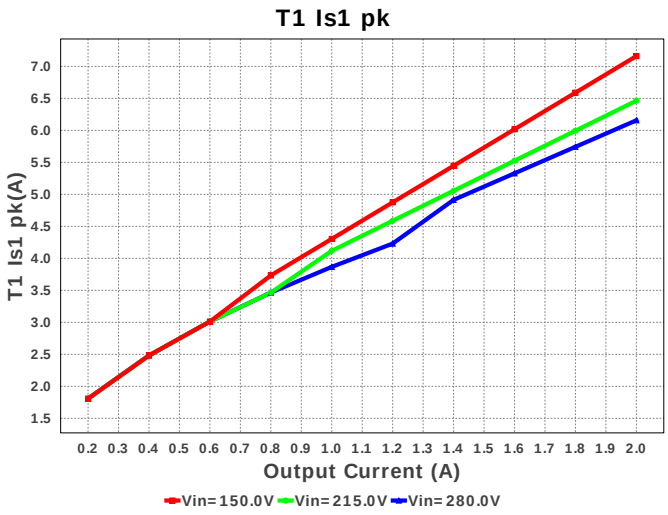


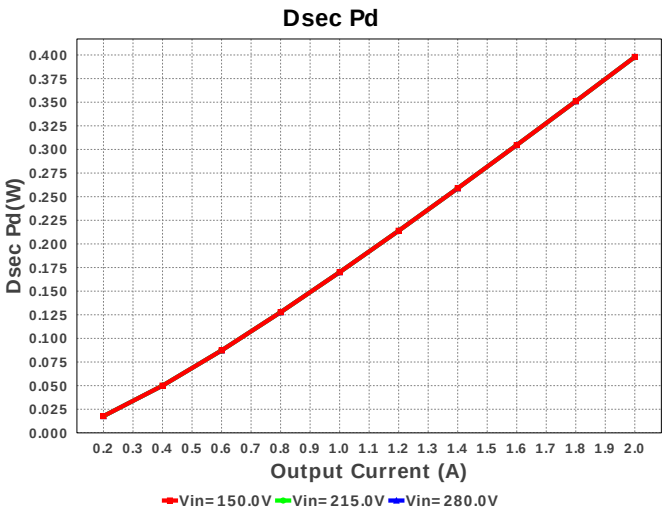


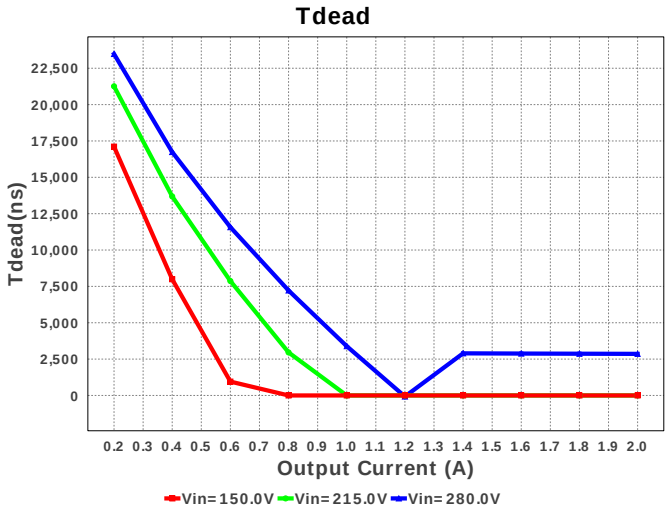


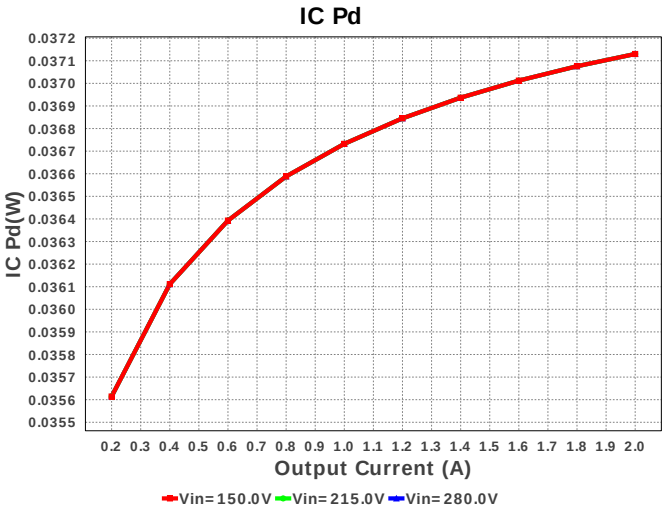


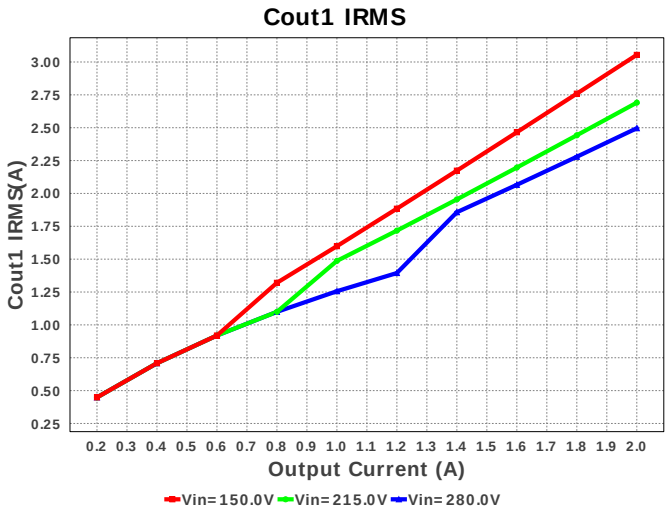


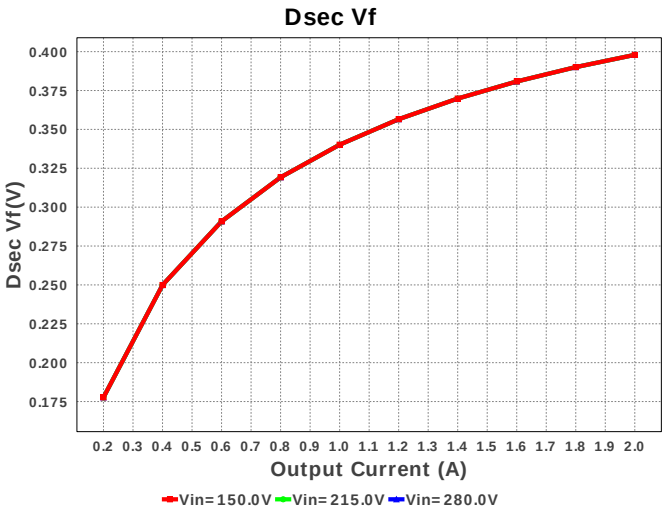


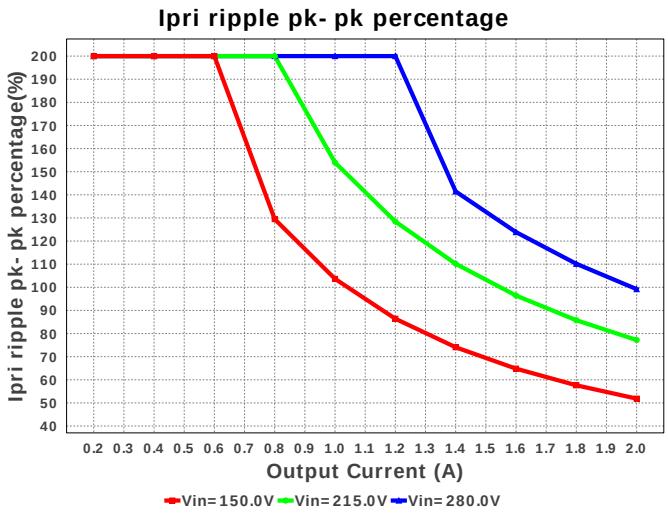


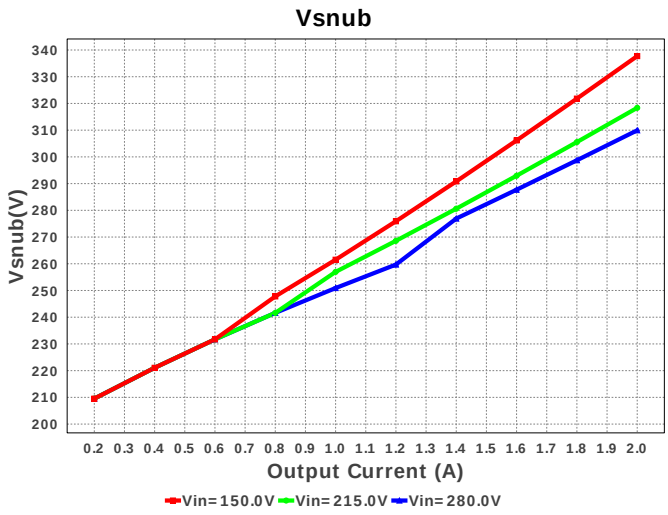


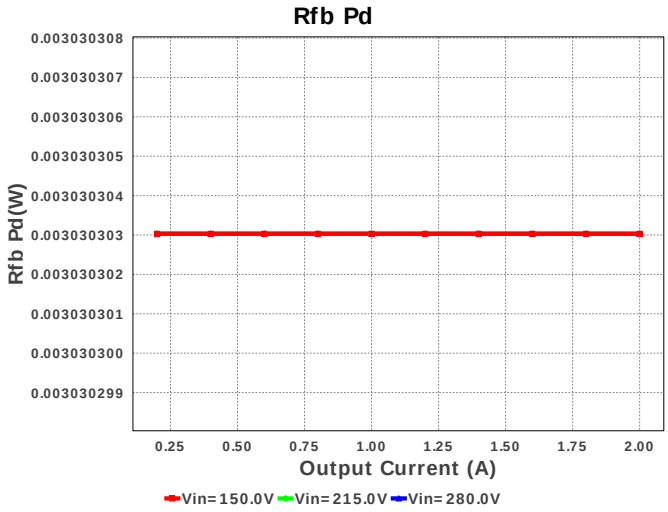


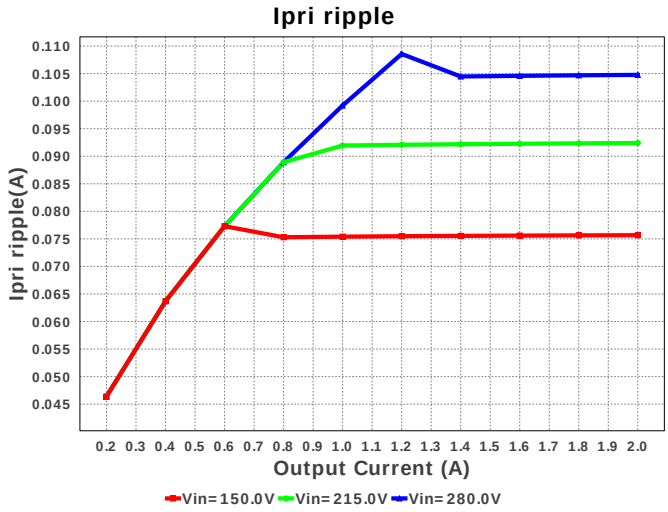


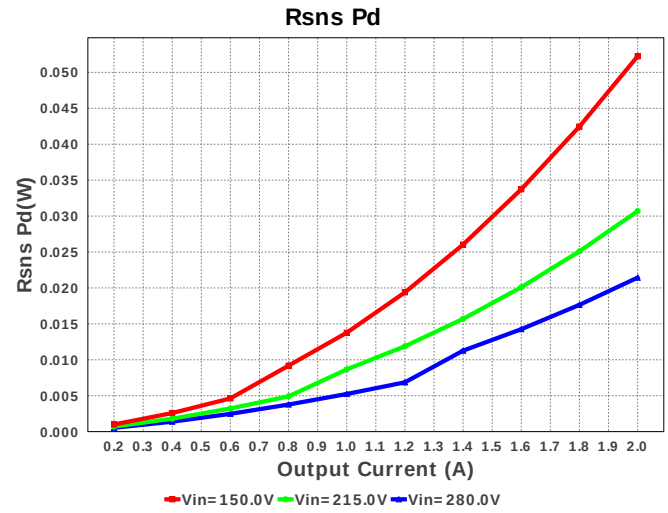


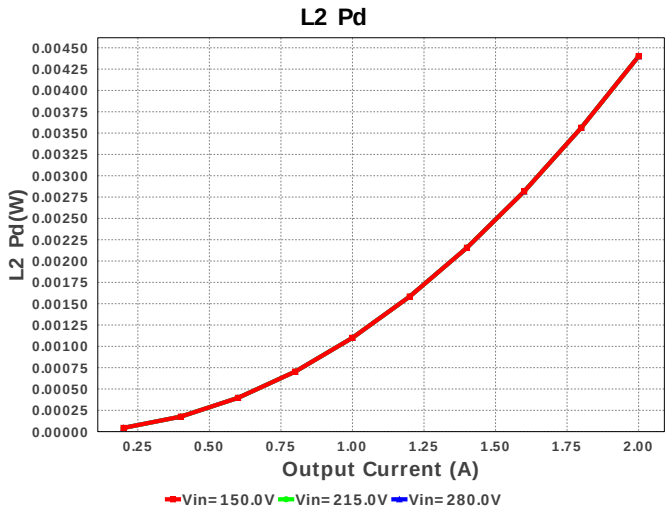


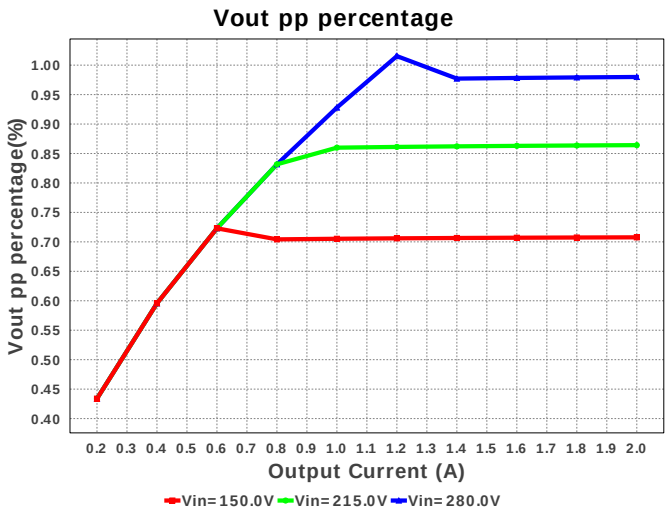


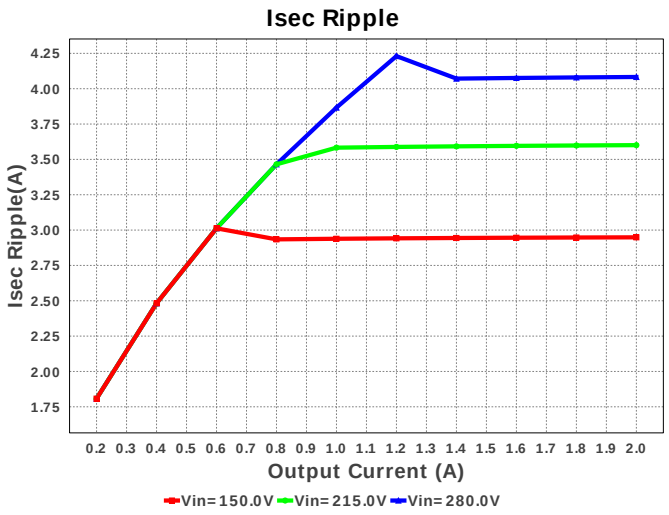


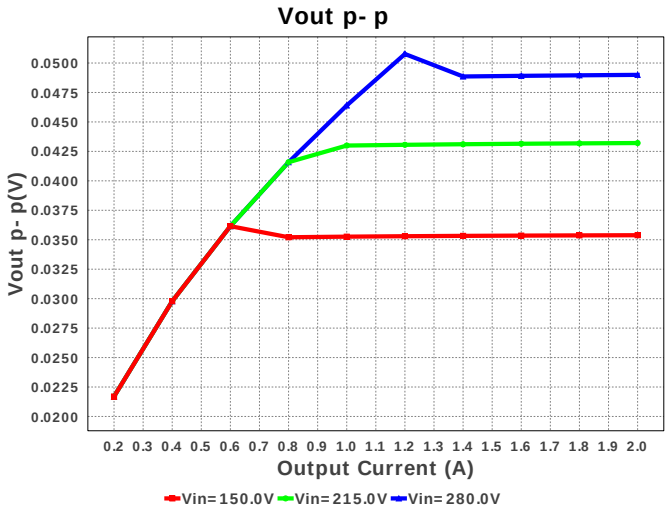


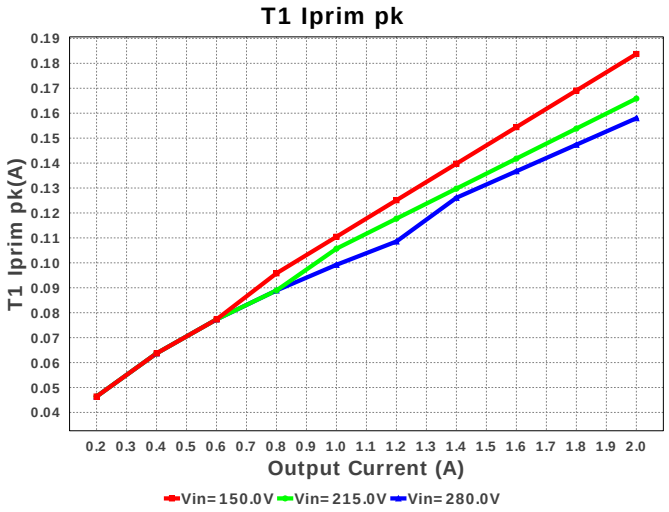












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	3.054 A	Current	Output capacitor1 RMS ripple current
2.	Iin Avg	74.916 mA	Current	Average input current
3.	Iout_DCM	645.491 mA	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	87.097 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	75.664 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	51.853 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	2.949 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	113.991 mA	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	183.752 mA	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	3.651 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	7.161 A	Current	Transformer Secondary1 Peak Current
12.	BOM Count	44	General	Total Design BOM count
13.	Daux trr	0.0 ns	General	Auxiliary Diode Reverse Recovery Time
14.	Dsec Vf	397.923 mV	General	Effective Forward Voltage Drop at the Operating Current
15.	Dsec trr	0.0 ns	General	Output Diode Reverse Recovery Time
16.	Dsec2 Vf	397.923 mV	General	Effective Forward Voltage Drop at the Operating Current
17.	Dsnub trr	35.0 ns	General	Snubber Diode Reverse Recovery Time
18.	FootPrint	2.179 k mm^2	General	Total Foot Print Area of BOM components
19.	Frequency	25.257 kHz	General	Switching frequency
20.	Pout	10.0 W	General	Total output power
21.	Tdead	0.0 ns	General	Approximate Dead Time of the Regulator
22.	Toff	13.925 us	General	Approximate Converter Off Time
23.	Ton Act	23.632 us	General	Approximate Converter On Time
24.	Total BOM	$0.0	General	Total BOM Cost
25.	Tsw	39.593 us	General	Switching Time Period
26.	Vaux	10.449 V	General	Auxiliary Voltage
27.	Vsnub	337.719 V	General	Voltage Across the Snubber
28.	Vout Actual	4.99 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
29.	Vout OP	5.0 V	Op_Point	Operational Output Voltage

#	Name	Value	Category	Description
30.	Duty Cycle	59.688 %	Op_point	Duty cycle
31.	Efficiency	88.989 %	Op_point	Steady state efficiency
32.	IC Tj	31.857 degC	Op_point	IC junction temperature
33.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
34.	IOUT_OP	2.0 A	Op_point	Iout operating point
35.	M1 TjOP	30.94 degC	Op_point	M1 MOSFET junction temperature
36.	Vout p-p	35.384 mV	Op_point	Peak-to-peak output ripple voltage
37.	Cin Pd	154.195 µW	Power	Input capacitor power dissipation
38.	Cout1 Pd	111.936 mW	Power	Output capacitor1 power dissipation
39.	Dsec Pd	397.923 mW	Power	Secondary Diode Power Dissipation
40.	Dsec2 Pd	397.923 mW	Power	Secondary Diode Power Dissipation
41.	IC Pd	37.13 mW	Power	IC power dissipation
42.	L2 Pd	4.4 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
43.	M1 Pd	15.045 mW	Power	M1 MOSFET total power dissipation
44.	Paux	5.026 mW	Power	Power Dissipation in Raux and Daux
45.	Pd Rstartup	172.325 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
46.	Rdrv Pd	1.127 µW	Power	Power Dissipation in Gate Drive Resistor
47.	Rfb Pd	3.03 mW	Power	Rfb Power Dissipation
48.	Rsns Pd	52.236 mW	Power	Current Limit Sense Resistor Power Dissipation
49.	Snubber Pd	224.717 mW	Power	Snubber Power Dissipation
50.	T1 Pd	251.852 mW	Power	Estimated Losses in Transformer
51.	Total Pd	0.0 W	Power	Total Power Dissipation
52.	Vout Tolerance	2.173 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
53.	Vout pp percentage	707.682 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	280.0	Maximum input voltage
3.	VinMin	150.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	UCC28C40	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. UCC28C40 Product Folder : http://www.ti.com/product/UCC28C40 : contains the data sheet and other resources.