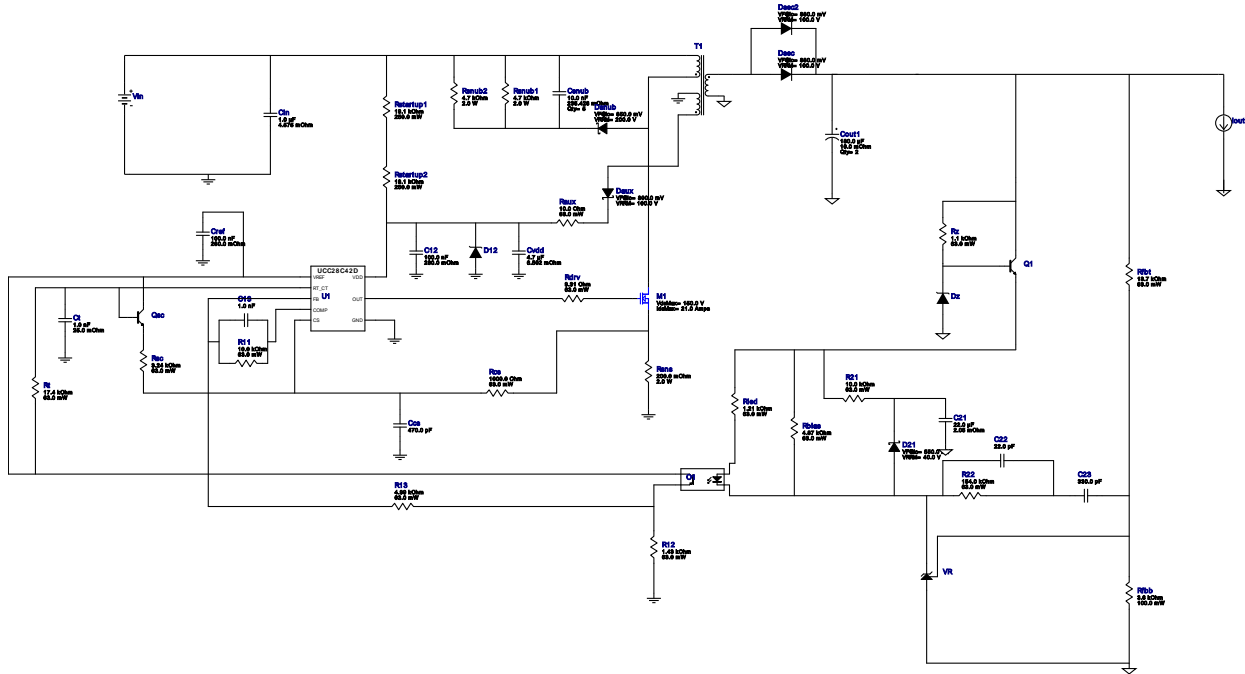




































WEBENCH® Design Report

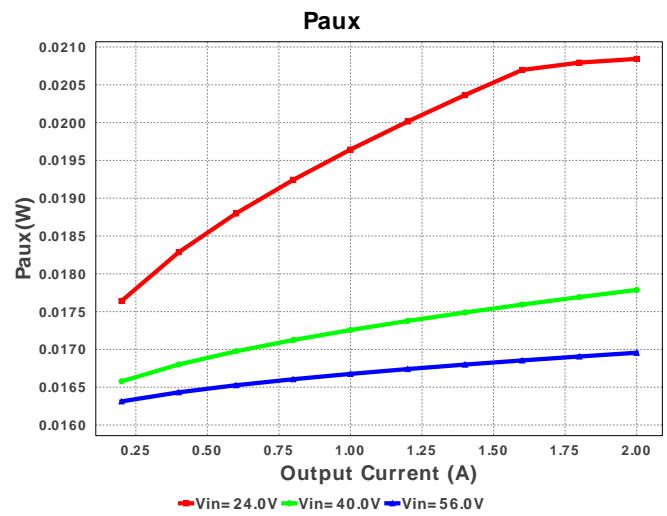
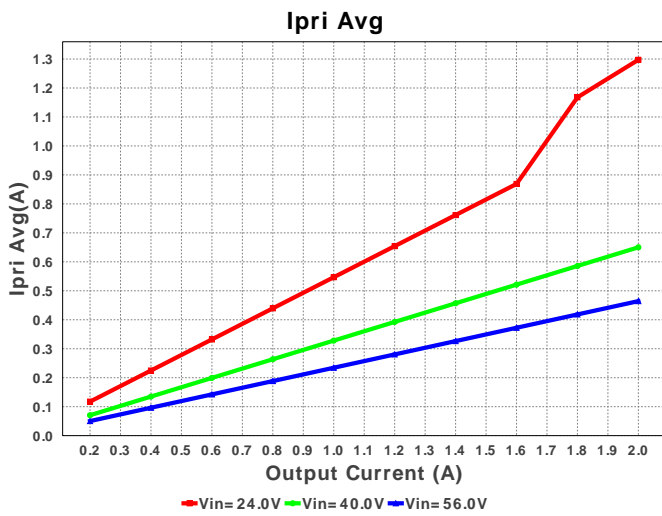
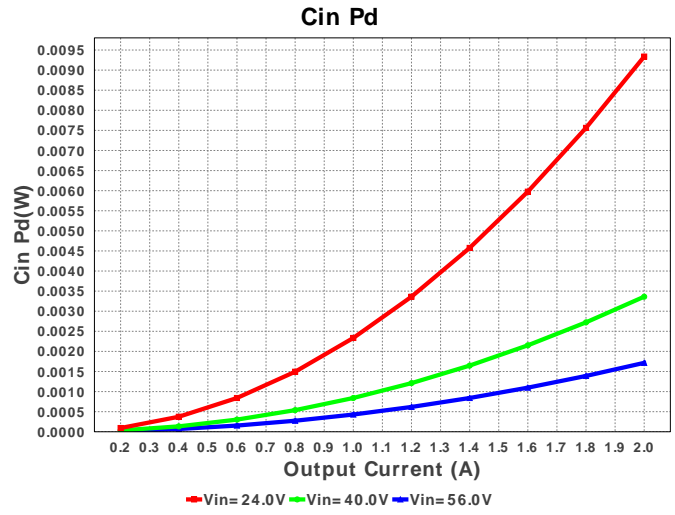
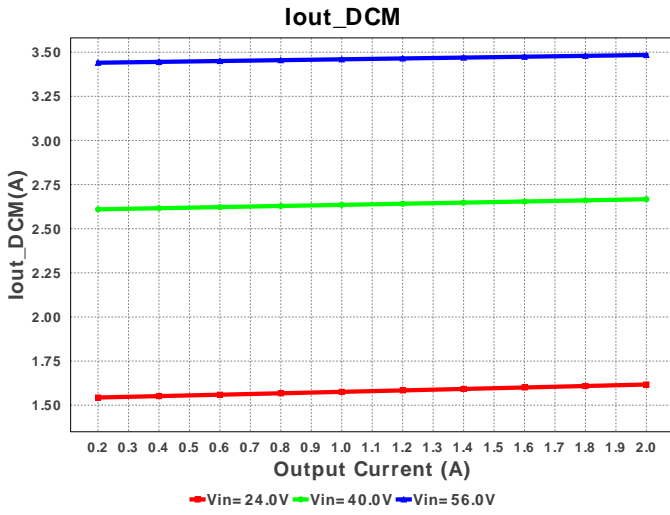
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 UCC28C42DR 24.0V-56.0V to 12.00V @ 2.0A

Electrical BOM

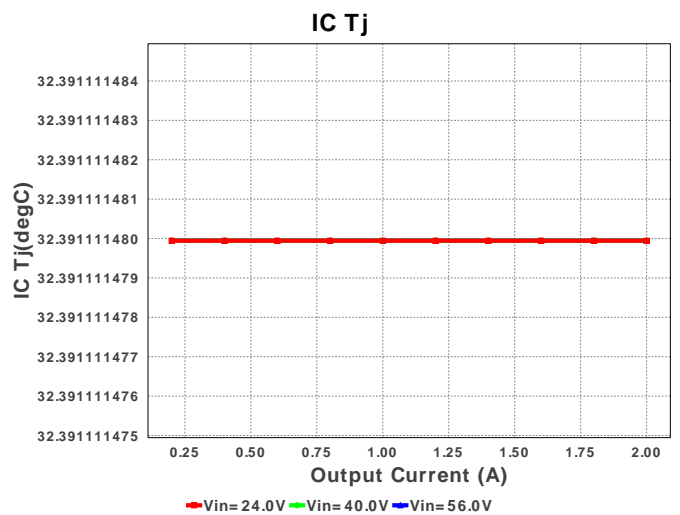
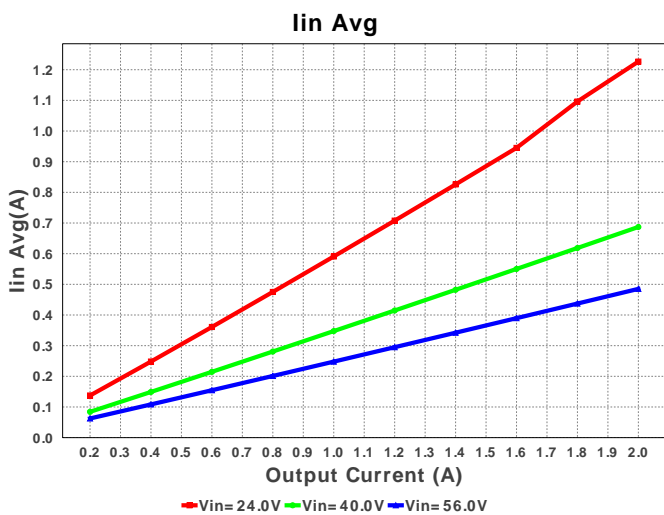
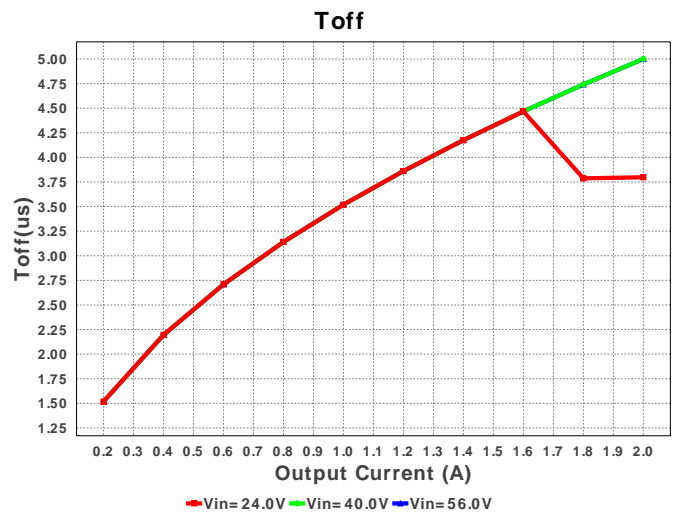
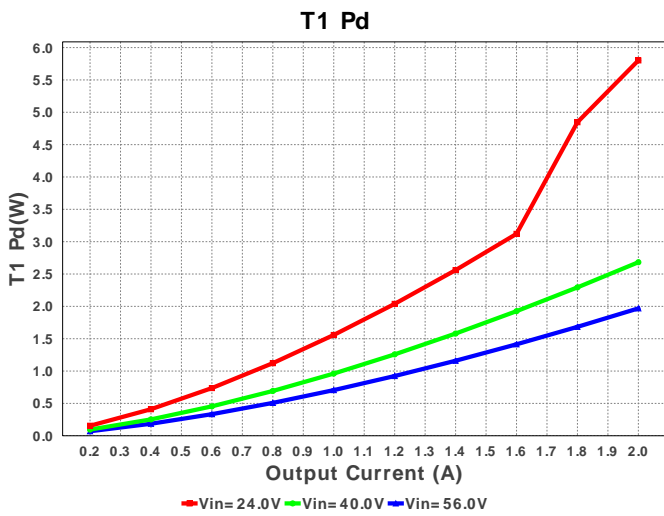
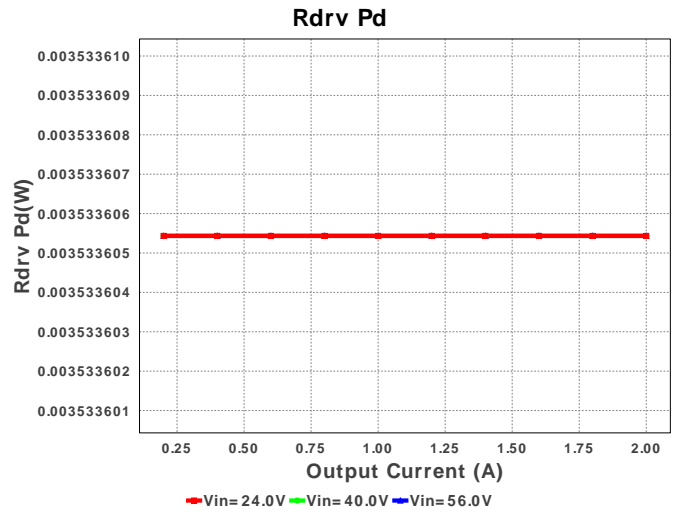
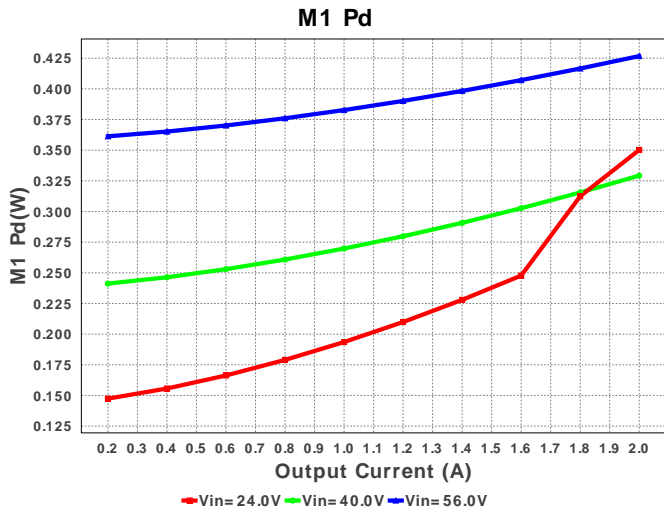
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1.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	C13	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	C21	TDK	C2012X5R1V226M125AC Series= X5R	Cap= 22.0 uF ESR= 2.05 mOhm VDC= 35.0 V IRMS= 4.5559 A	1	\$0.31	0805 7 mm ²
4.	C22	Kemet	C0805C220K3GACTU Series= C0G/NP0	Cap= 22.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	C23	Samsung Electro-Mechanics	CL21C331JBANFNC Series= C0G/NP0	Cap= 330.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Ccs	Yageo America	CC0805KRX7R9BB471 Series= X7R	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
7.	Cin	TDK	C3216X5R2A105K160AA Series= X5R	Cap= 1.0 uF ESR= 4.575 mOhm VDC= 100.0 V IRMS= 3.39639 A	1	\$0.11	1206_180 11 mm ²
8.	Cout1	Panasonic	25SVPF180M Series= ?	Cap= 180.0 uF ESR= 16.0 mOhm VDC= 25.0 V IRMS= 4.65 A	2	\$0.61	 CAPSMT_62_E12 106 mm ²

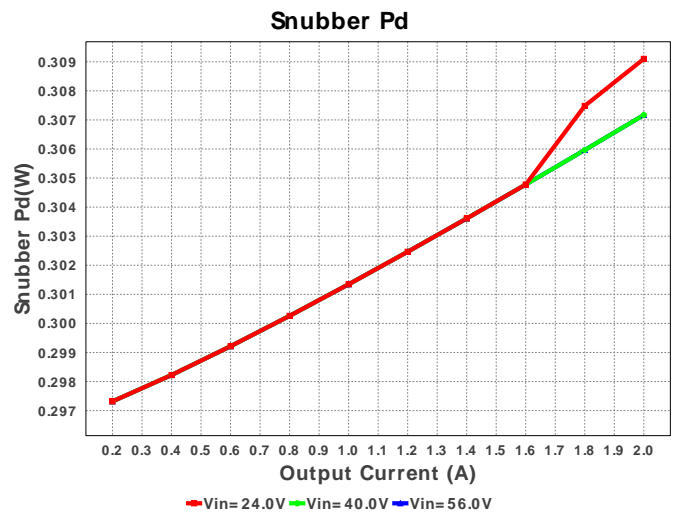
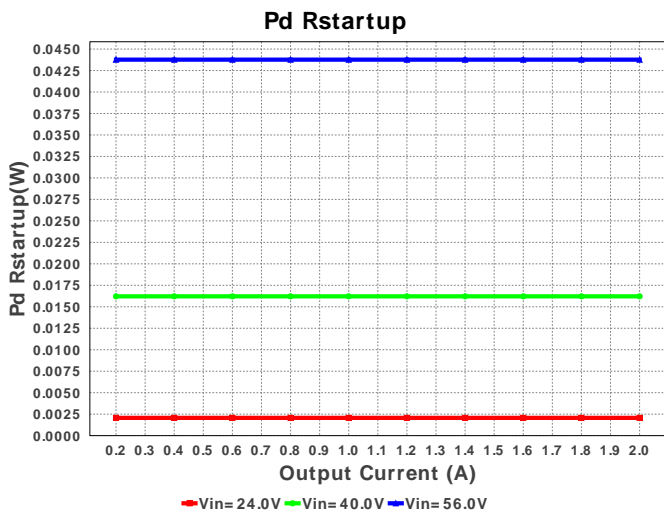
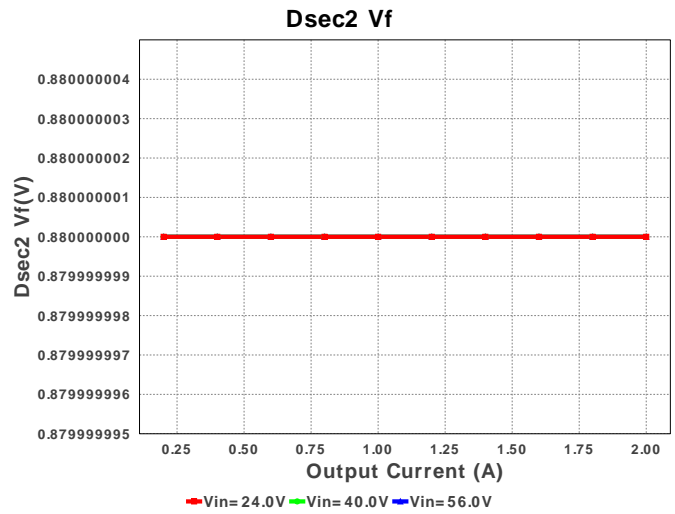
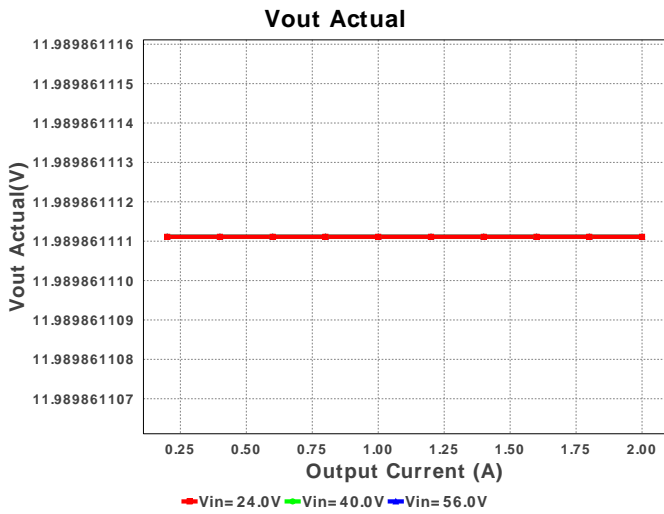
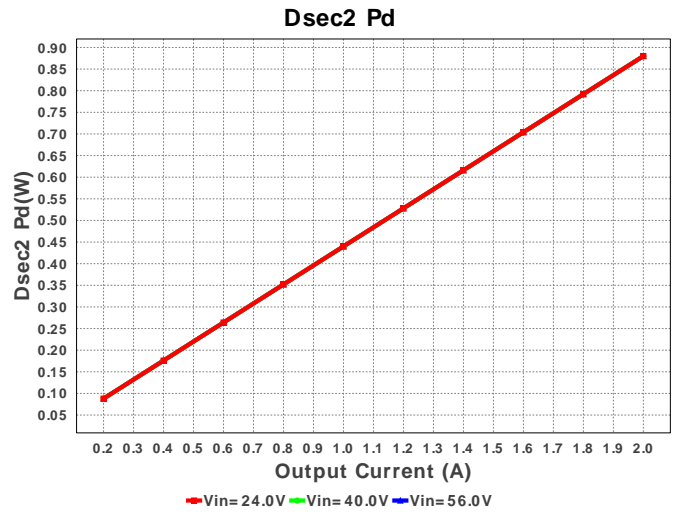
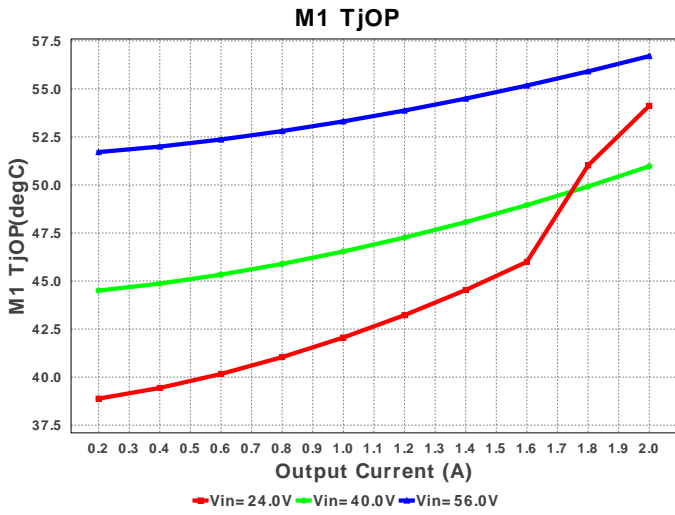
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9.	Cref	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
10.	Csnub	TDK	CGA3E2X7R2A103K080AA Series= X7R	Cap= 10.0 nF ESR= 235.428 mOhm VDC= 100.0 V IRMS= 397.0 mA	5	\$0.01	 0603 5 mm ²
11.	Ct	Kemet	C0805C102J5GACTU Series= C0G/NP0	Cap= 1.0 nF ESR= 25.0 mOhm VDC= 50.0 V IRMS= 1.71 A	1	\$0.02	 0805 7 mm ²
12.	Cvdd	MuRata	GRM319R61E475KA12D Series= X5R	Cap= 4.7 uF ESR= 6.502 mOhm VDC= 25.0 V IRMS= 1.8691 A	1	\$0.14	 1206 11 mm ²
13.	D12	Diodes Inc.	MMSZ5248B-7-F	Zener	1	\$0.04	 SOD-123 13 mm ²
14.	D21	Fairchild Semiconductor	SS24FL	VF@Io= 550.0 mV VRRM= 40.0 V	1	\$0.07	 SOD-123F 12 mm ²
15.	Daux	Fairchild Semiconductor	SSA210	VF@Io= 800.0 mV VRRM= 100.0 V	1	\$0.10	 SMA 37 mm ²
16.	Dsec	Vishay-Semiconductor	SS10PH10-M3/86A	VF@Io= 880.0 mV VRRM= 100.0 V	1	\$0.29	 TO-277A 57 mm ²
17.	Dsec2	Vishay-Semiconductor	SS10PH10-M3/86A	VF@Io= 880.0 mV VRRM= 100.0 V	1	\$0.29	 TO-277A 57 mm ²
18.	Dsnub	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	\$0.21	 PowerDI123 13 mm ²
19.	Dz	ON Semiconductor	BZX84C9V1LT1G	Zener	1	\$0.02	 SOT-23 14 mm ²
20.	M1	Infineon Technologies	BSZ520N15NS3 G	VdsMax= 150.0 V IdsMax= 21.0 Amps	1	\$0.55	 PG-TSDSON-8 19 mm ²
21.	O1	Fairchild Semiconductor	FOD817A	Optocoupler	1	\$0.10	 DIP-4 71 mm ²
22.	Q1	ON Semiconductor	BC846BLT1G	Bipolar Transistor	1	\$0.02	 SOT-23 14 mm ²
23.	Qsc	STMicroelectronics	2N2222A	Bipolar Transistor	1	\$0.94	 TO-18 57 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	CRCW04021K43FKED Series= CRCW..e3	Res= 1.43 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	CRCW0402154KFKED Series= CRCW..e3	Res= 154.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

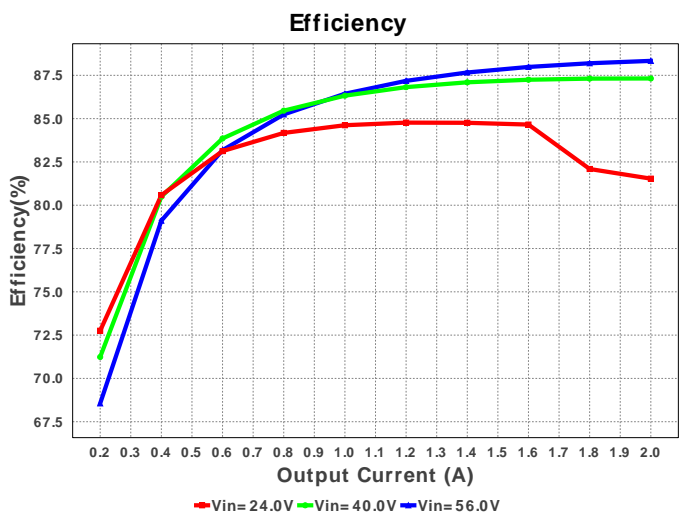
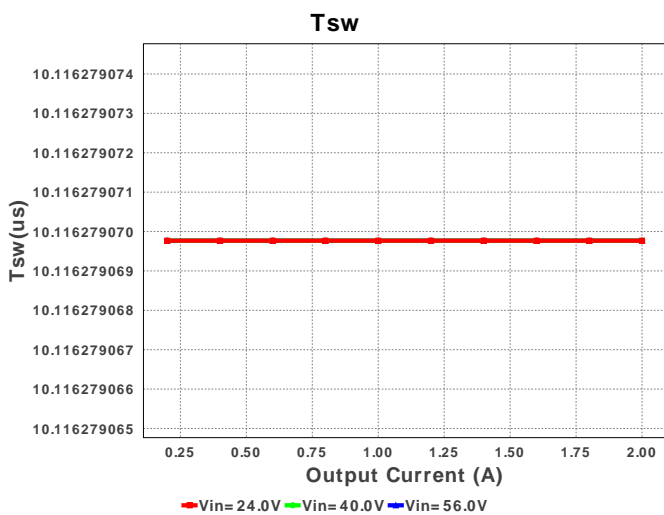
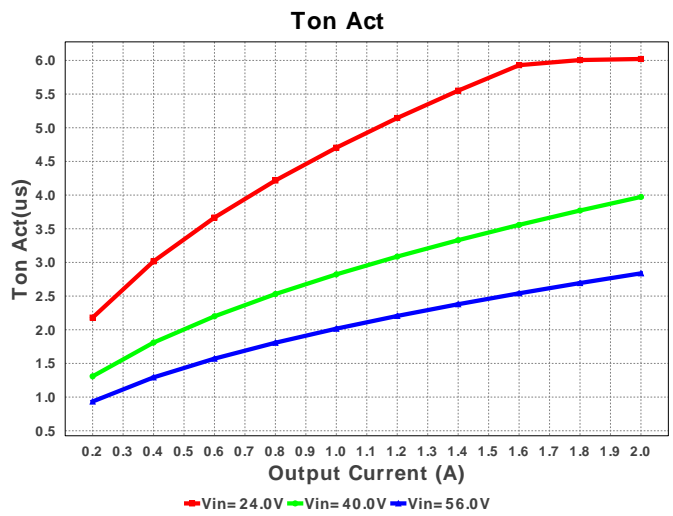
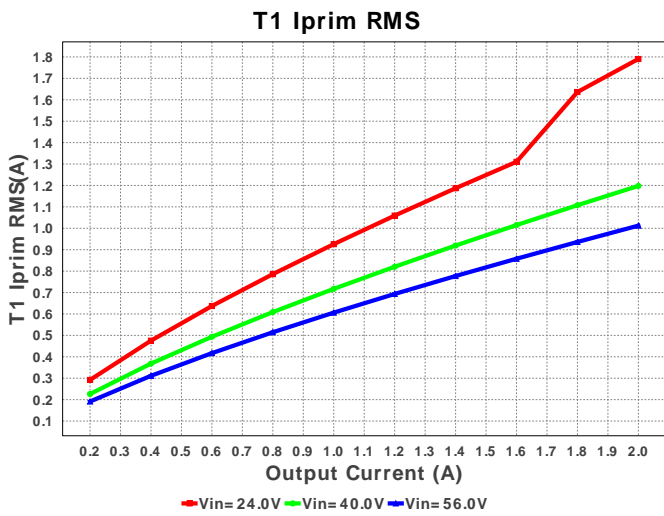
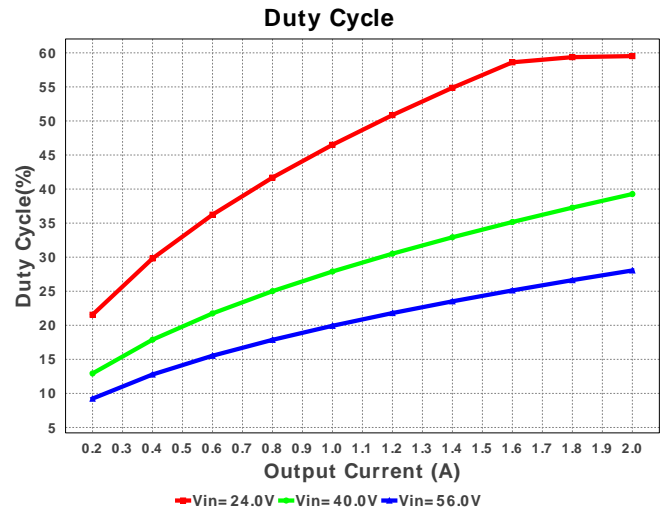
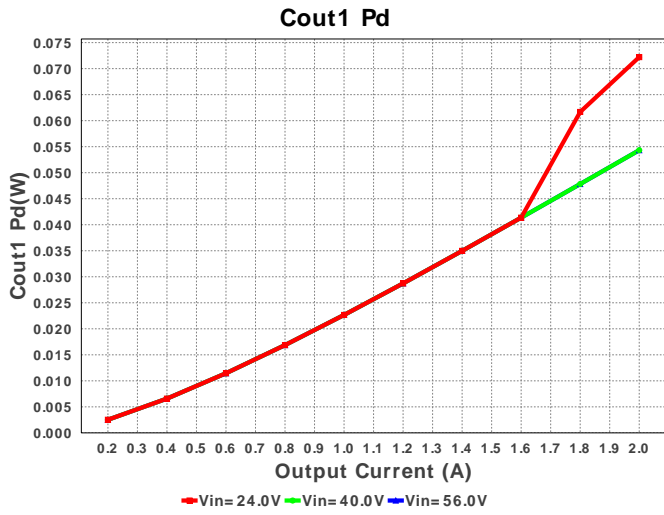
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
29.	Raux	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
30.	Rbias	Vishay-Dale	CRCW04024K87FKED Series= CRCW..e3	Res= 4.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
31.	Rcs	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
32.	Rdrv	Vishay-Dale	CRCW04029R31FKED Series= CRCW..e3	Res= 9.31 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
33.	Rfbb	Yageo America	RC0603FR-073K6L Series= ?	Res= 3.6 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
34.	Rfbt	Vishay-Dale	CRCW040213K7FKED Series= CRCW..e3	Res= 13.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
35.	Rled	Vishay-Dale	CRCW04021K21FKED Series= CRCW..e3	Res= 1.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
36.	Rsc	Vishay-Dale	CRCW04023K24FKED Series= CRCW..e3	Res= 3.24 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
37.	Rsns	Stackpole Electronics Inc	CSRN2512FKR200 Series= ?	Res= 200.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	\$0.13	 2512 43 mm ²
38.	Rsub1	Vishay-Bcomponents	PR02000204701JR500 Series= ?	Res= 4.7 kOhm Power= 2.0 W Tolerance= 5.0%	1	\$0.05	 PR02 117 mm ²
39.	Rsub2	Vishay-Bcomponents	PR02000204701JR500 Series= ?	Res= 4.7 kOhm Power= 2.0 W Tolerance= 5.0%	1	\$0.05	 PR02 117 mm ²
40.	Rstartup1	Panasonic	ERJ-8ENF1912V Series= ERJ-8E	Res= 19.1 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
41.	Rstartup2	Panasonic	ERJ-8ENF1912V Series= ERJ-8E	Res= 19.1 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
42.	Rt	Vishay-Dale	CRCW040217K4FKED Series= CRCW..e3	Res= 17.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
43.	Rz	Vishay-Dale	CRCW04021K10FKED Series= CRCW..e3	Res= 1.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
44.	T1	Core=TDK , CoilFormer=TDK	Core=B66417G0000X197 , CoilFormer=B66418W1008D001	Lp= 48.0 µH Turns Ratio(Nas)= 10:9 Turns Ratio(Nps)= 22:9 Npri= 22.0 Naux= 10.0 Nsec= 9.0	1	\$0.90	 TDK_B66305 406 mm ²
45.	U1	Texas Instruments	UCC28C42DR	Switcher	1	\$0.60	 D0008A 57 mm ²

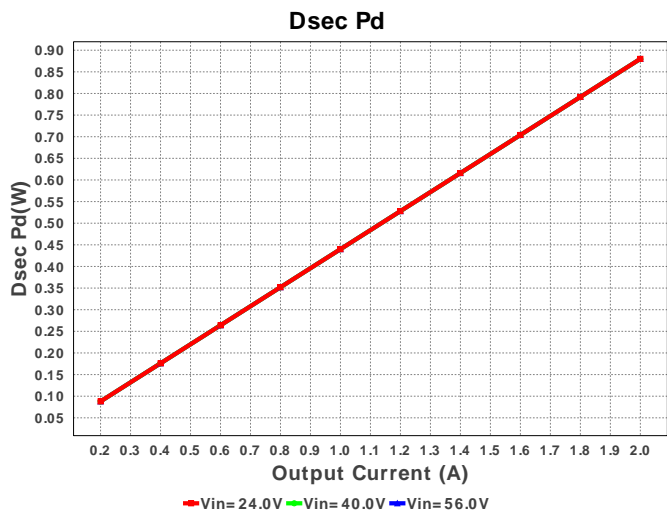
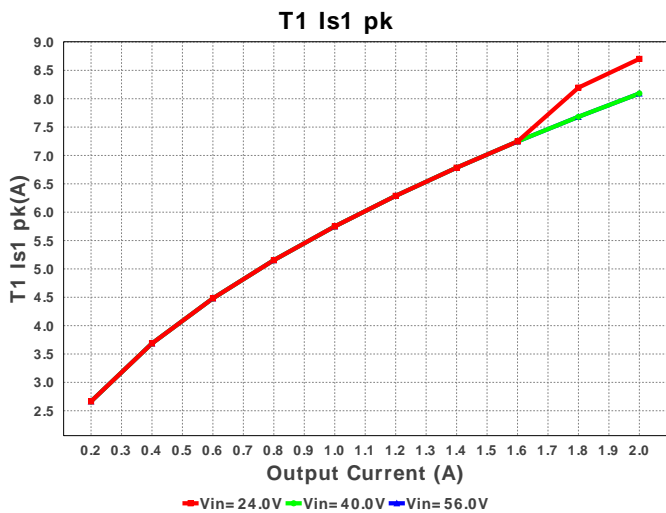
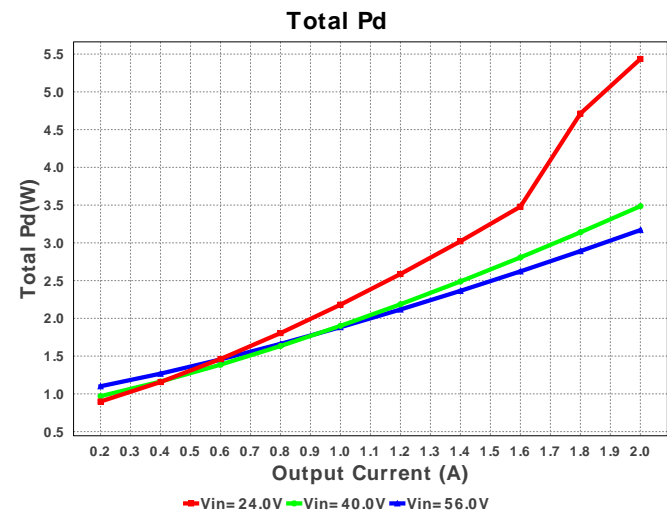
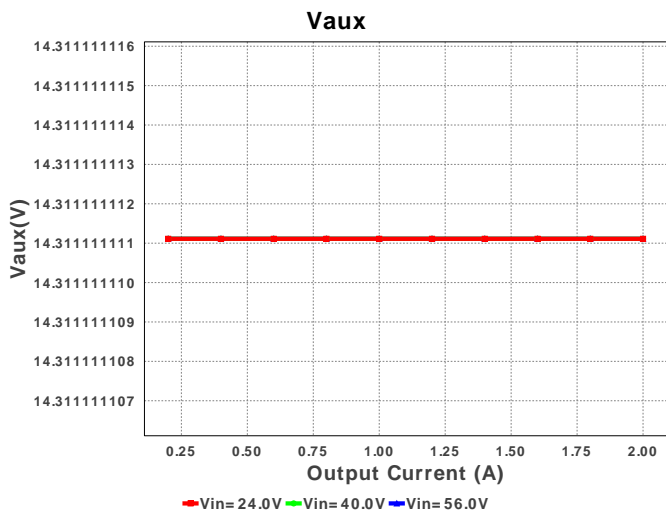
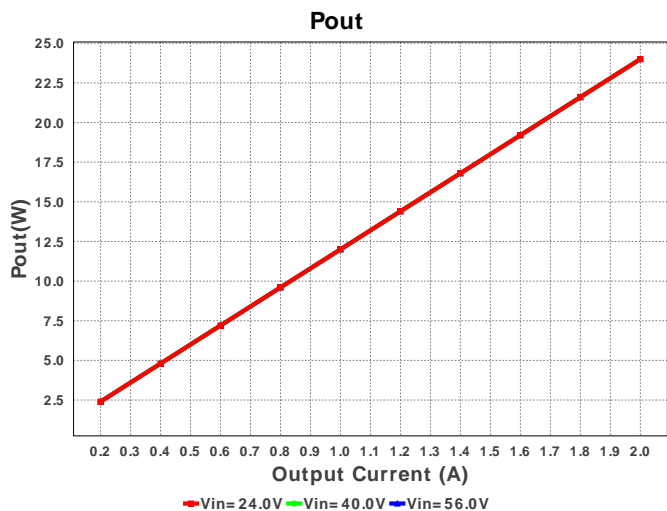
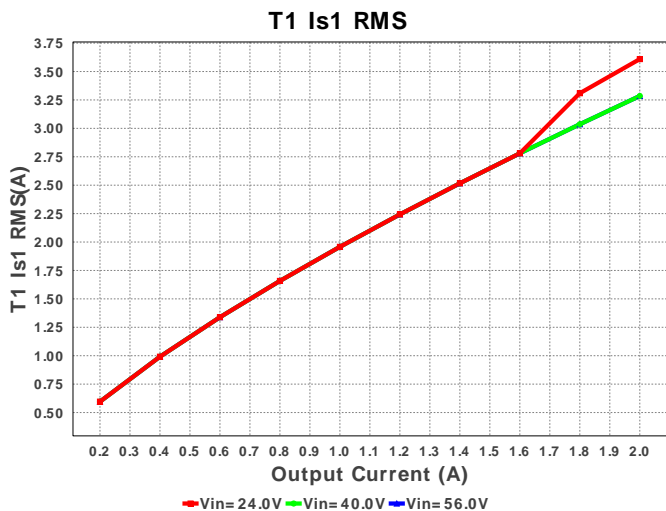
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
46.	VR	Texas Instruments	TL431AIDBZR	Voltage References	1	\$0.08	 DBZ0003A 14 mm ²

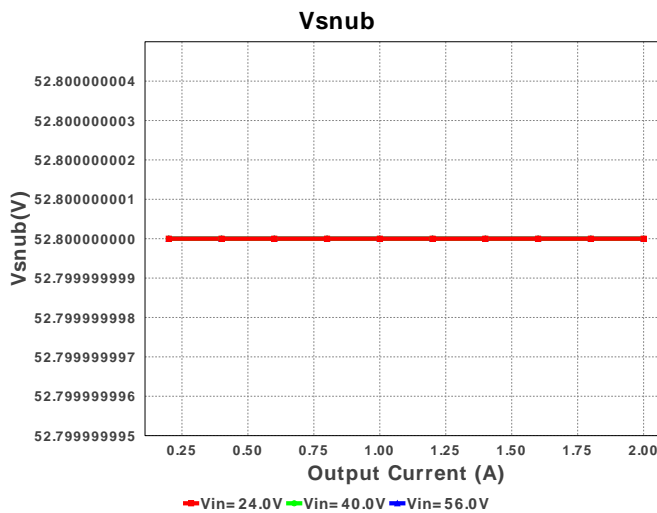
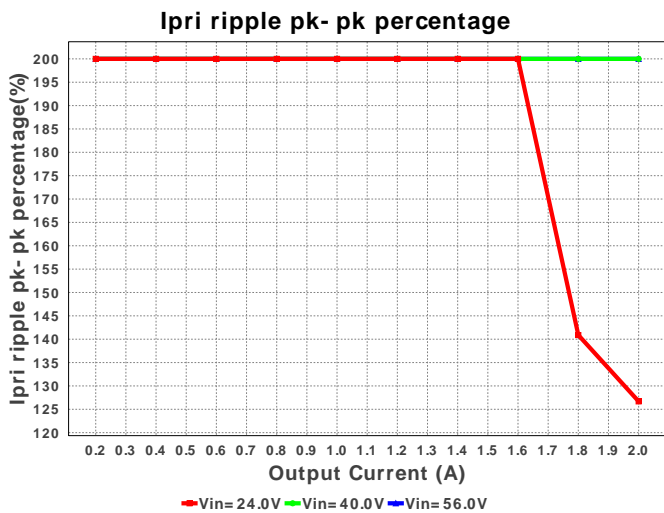
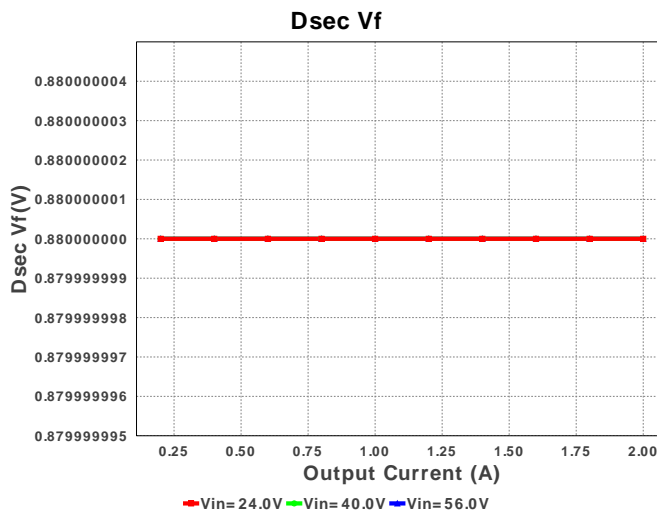
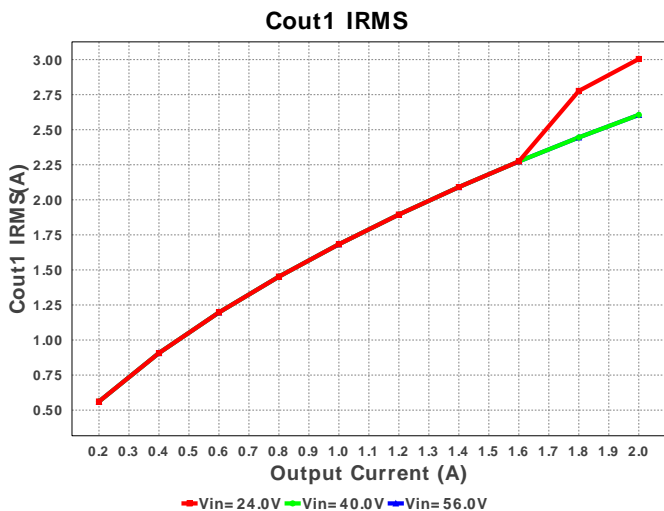
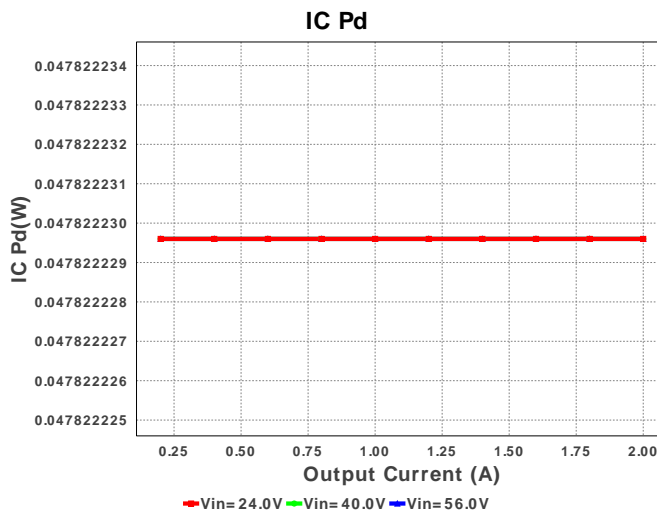
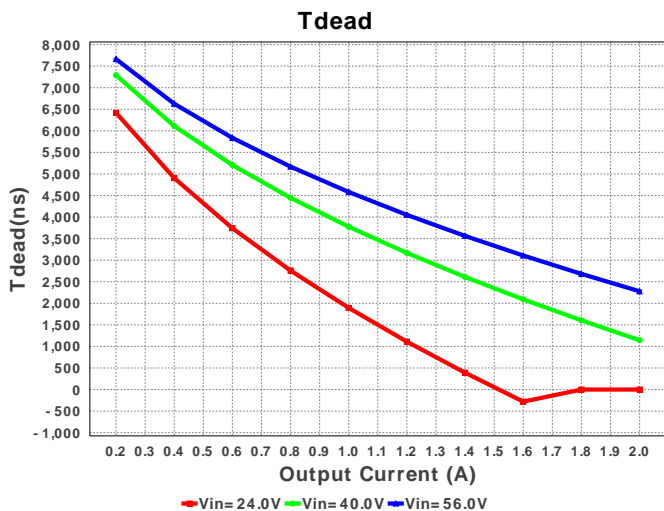


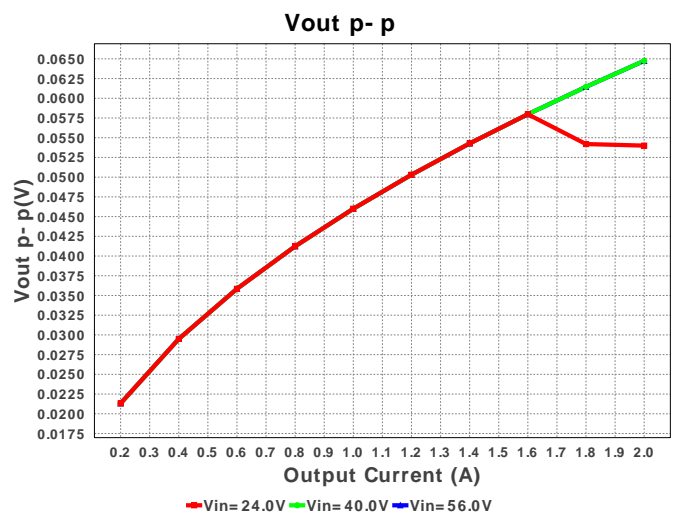
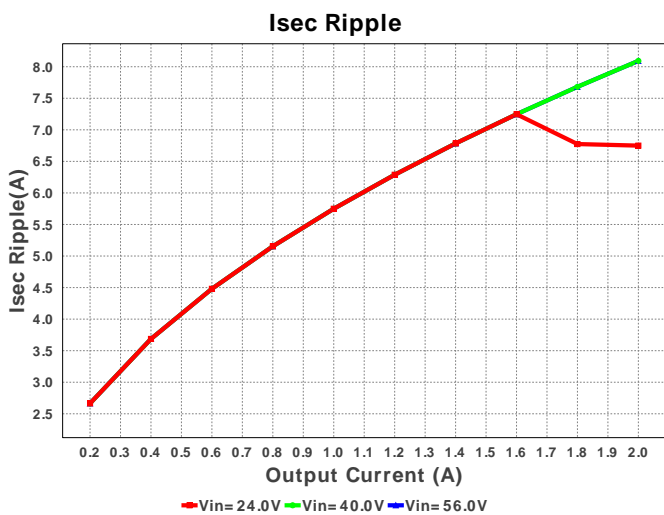
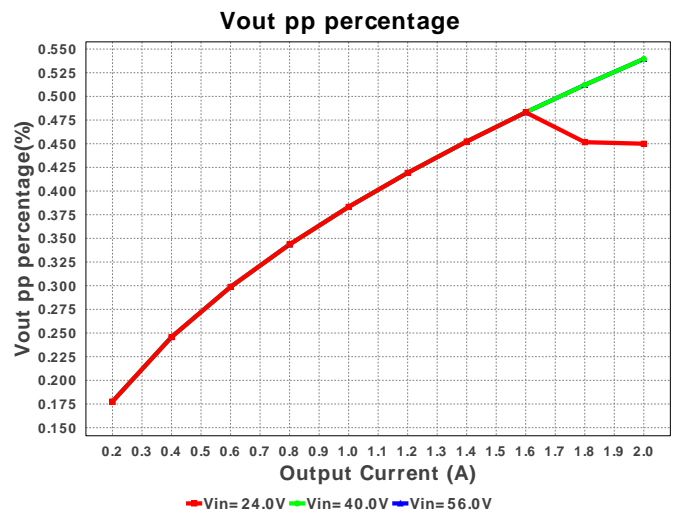
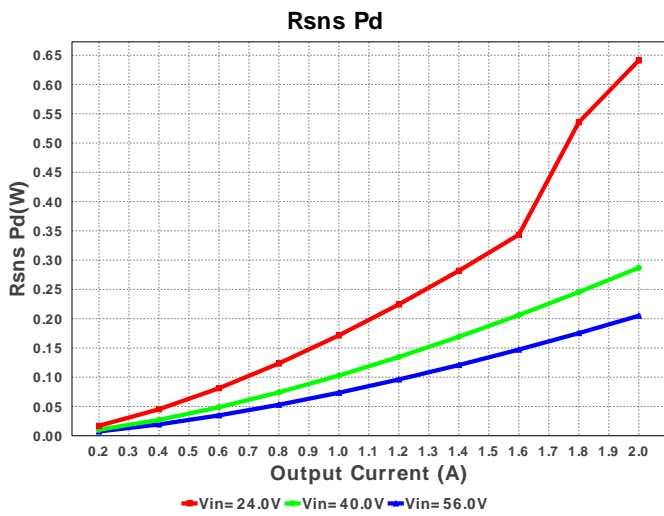
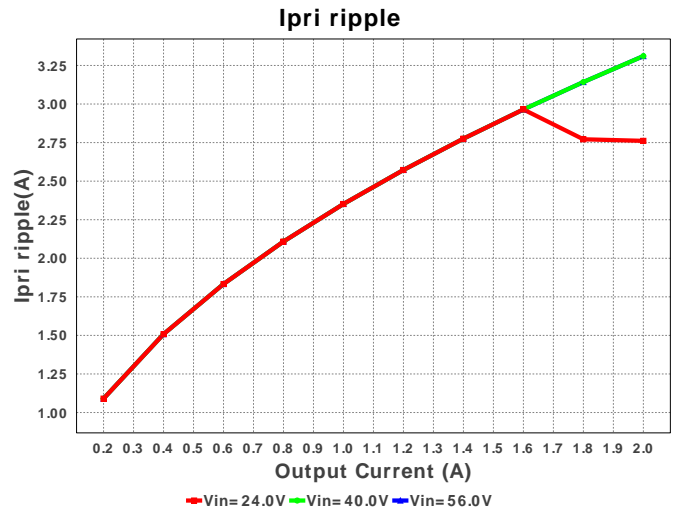
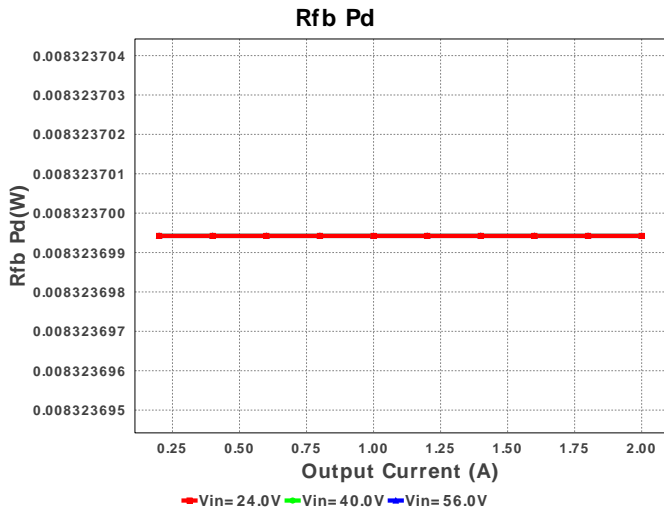


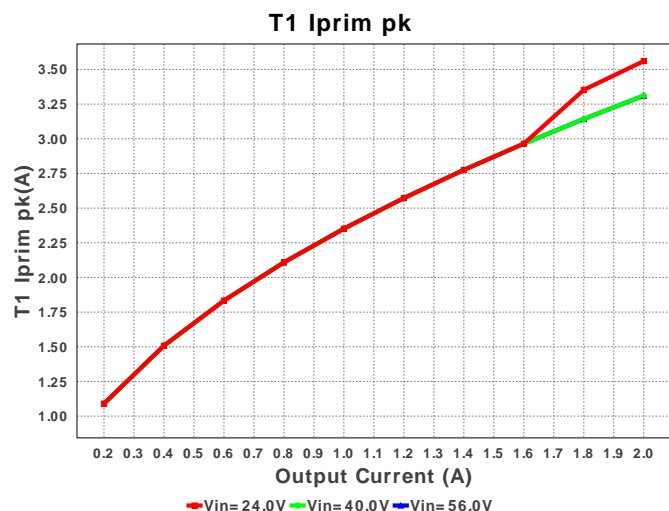












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	3.003 A	Current	Output capacitor1 RMS ripple current
2.	Iin Avg	1.226 A	Current	Average input current
3.	Iout_DCM	1.611 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	1.297 A	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	2.751 A	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	126.223 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	6.725 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	1.79 A	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	3.555 A	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	3.608 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	8.69 A	Current	Transformer Secondary1 Peak Current
12.	BOM Count	51	General	Total Design BOM count
13.	Daux trr	8.02 ns	General	Auxiliary Diode Reverse Recovery Time
14.	Dsec Vf	880.0 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	880.0 mV	General	Effective Forward Voltage Drop at the Operating Current
17.	Dsnub trr	0.0 ns	General	Snubber Diode Reverse Recovery Time
18.	FootPrint	1.499 k mm ²	General	Total Foot Print Area of BOM components
19.	Frequency	98.851 kHz	General	Switching frequency
20.	Mode	CCM	General	Conduction Mode
21.	Pout	24.0 W	General	Total output power
22.	Tdead	0.0 ns	General	Approximate Dead Time of the Regulator
23.	Toff	3.798 us	General	Approximate Converter Off Time
24.	Ton Act	6.021 us	General	Approximate Converter On Time
25.	Total BOM	\$6.52	General	Total BOM Cost
26.	Tsw	10.116 us	General	Switching Time Period
27.	Vaux	14.311 V	General	Auxiliary Voltage
28.	Vsnub	52.8 V	General	Voltage Across the Snubber
29.	Vout Actual	11.99 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
30.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
31.	Duty Cycle	59.521 %	Op_point	Duty cycle
32.	Efficiency	81.546 %	Op_point	Steady state efficiency
33.	IC Tj	32.391 degC	Op_point	IC junction temperature
34.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
35.	IOUT_OP	2.0 A	Op_point	Iout operating point
36.	M1 TjOP	54.062 degC	Op_point	M1 MOSFET junction temperature
37.	VIN_OP	24.0 V	Op_point	Vin operating point
38.	Vout p-p	53.799 mV	Op_point	Peak-to-peak output ripple voltage
39.	Cin Pd	9.337 mW	Power	Input capacitor power dissipation
40.	Cout1 Pd	72.124 mW	Power	Output capacitor1 power dissipation
41.	Dsec Pd	880.0 mW	Power	Secondary Diode Power Dissipation
42.	Dsec2 Pd	880.0 mW	Power	Secondary Diode Power Dissipation
43.	IC Pd	47.822 mW	Power	IC power dissipation
44.	M1 Pd	349.427 mW	Power	M1 MOSFET total power dissipation
45.	Paux	20.843 mW	Power	Power Dissipation in Raux and Daux
46.	Pd Rstartup	2.068 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
47.	Rdrv Pd	3.534 mW	Power	Power Dissipation in Gate Drive Resistor
48.	Rfb Pd	8.324 mW	Power	Rfb Power Dissipation
49.	Rsns Pd	640.574 mW	Power	Current Limit Sense Resistor Power Dissipation
50.	Snubber Pd	309.112 mW	Power	Snubber Power Dissipation

#	Name	Value	Category	Description
51.	T1 Pd	5.797 W	Power	Estimated Losses in Transformer
52.	Total Pd	5.431 W	Power	Total Power Dissipation
53.	Vout Tolerance	1.926 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
54.	Vout pp percentage	448.322 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	56.0	Maximum input voltage
3.	VinMin	24.0	Minimum input voltage
4.	Vout	12.0	Output Voltage
5.	base_pn	UCC28C42	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **UCC28C42** Product Folder : <http://www.ti.com/product/UCC28C42> : contains the data sheet and other resources.

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