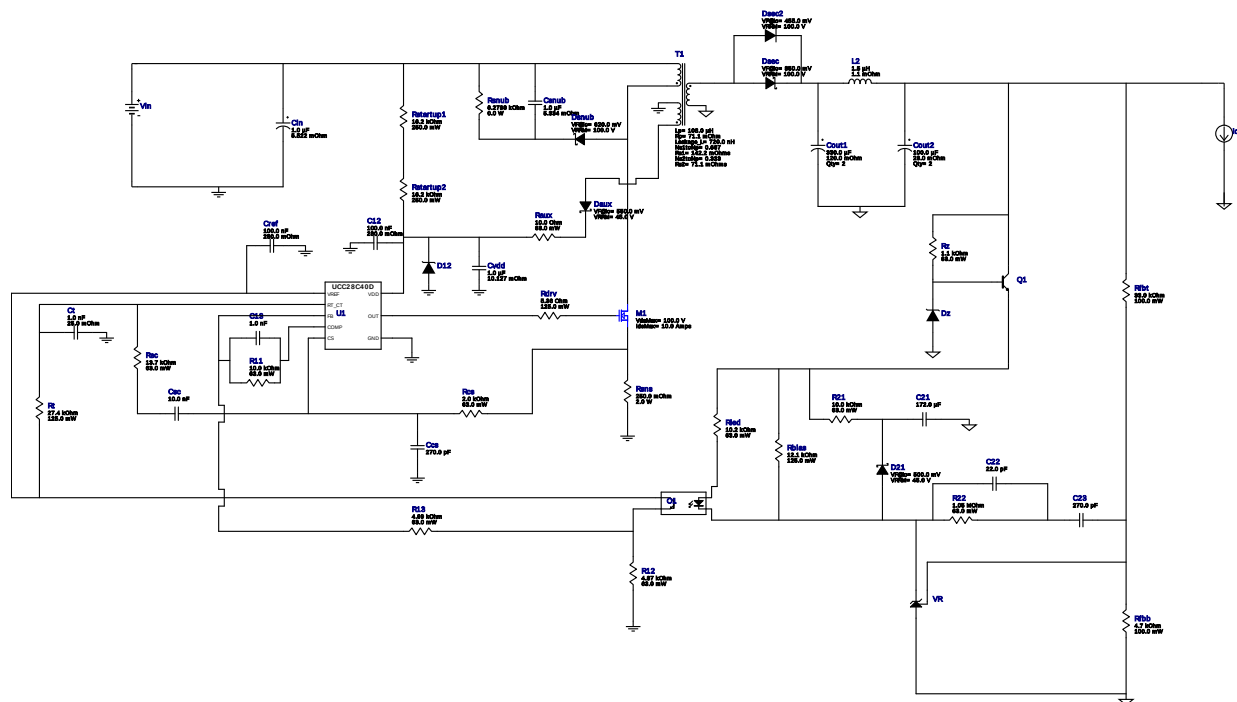
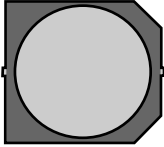
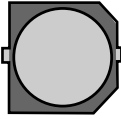
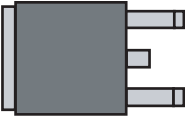
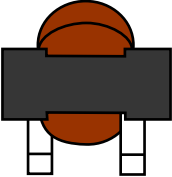


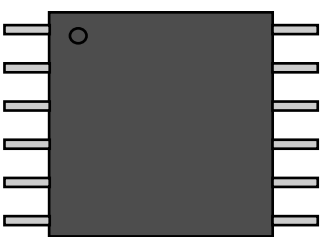


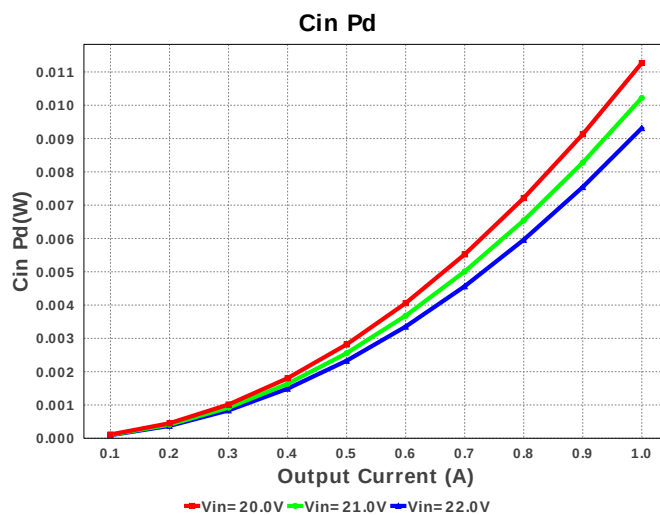
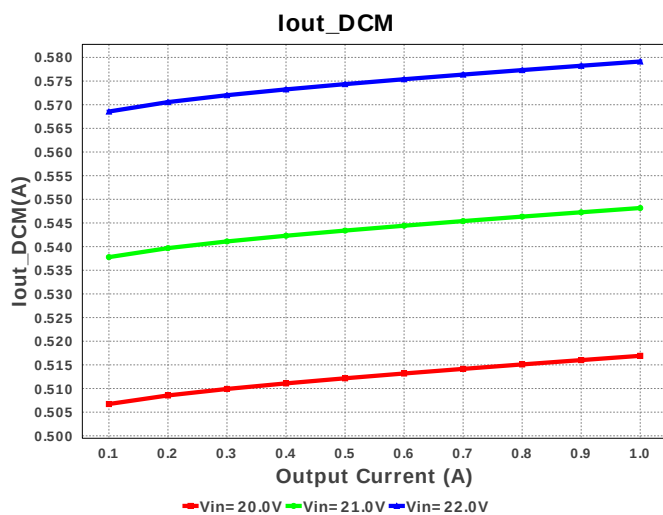
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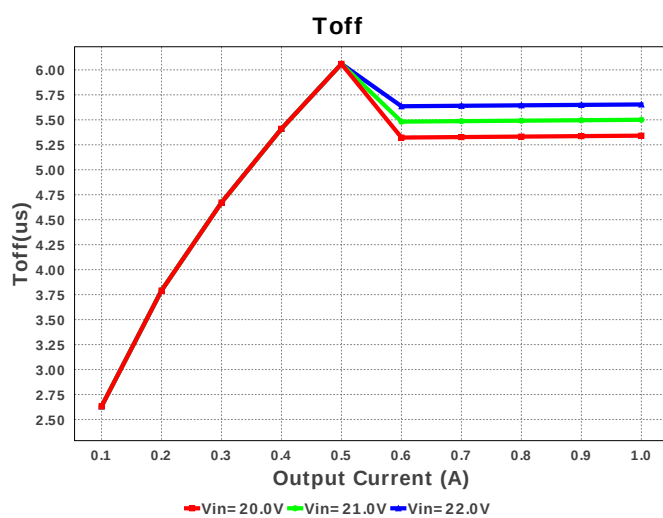
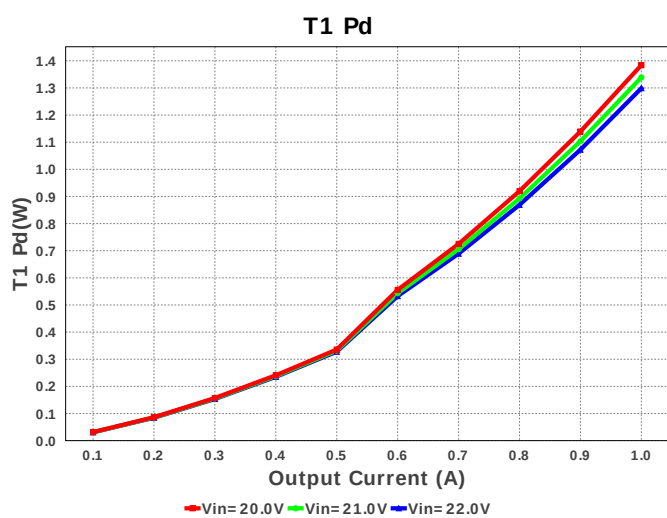
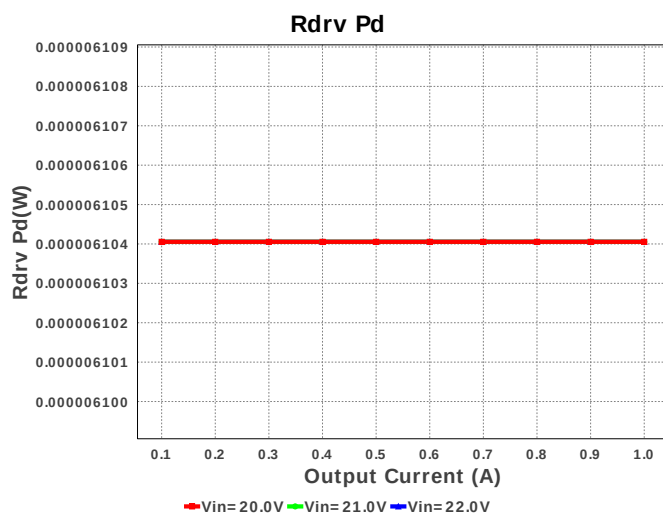
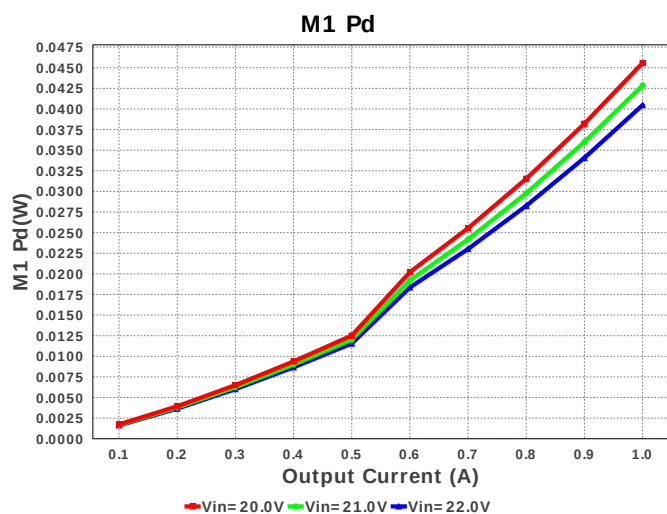
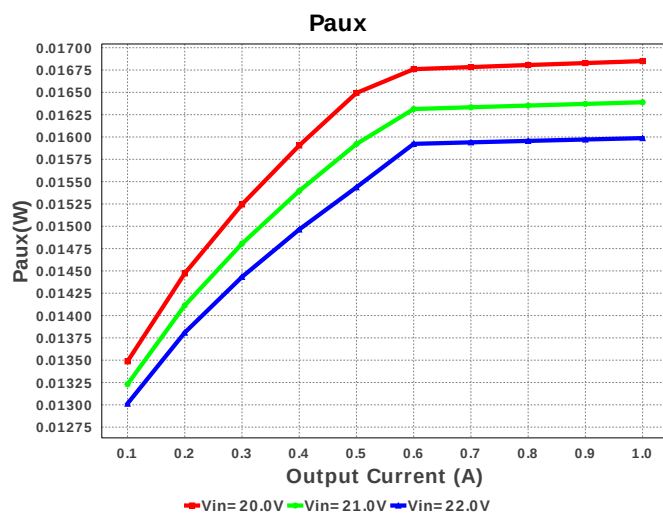
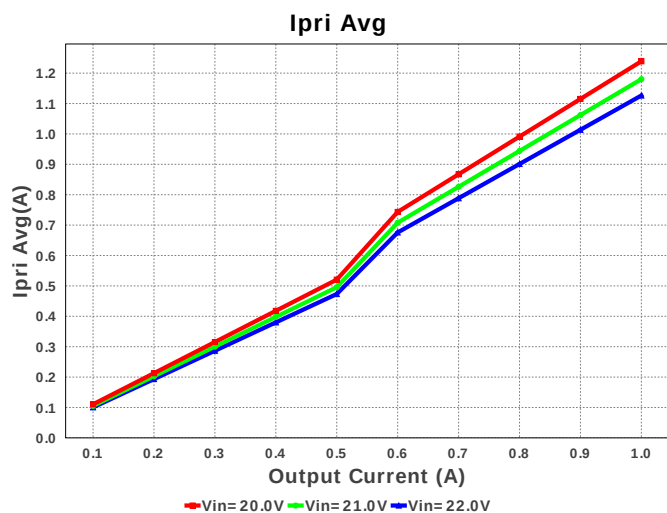
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	C13	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	C21	CUSTOM	CUSTOM Series= ?	Cap= 172.0 uF VDC= 36.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 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	Yageo America	CC0805KRX7R9BB271 Series= X7R	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Ccs	Yageo America	CC0805KRX7R9BB271 Series= X7R	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
7.	Cin	TDK	C1608X7R1V105K080AC Series= X7R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 35.0 V IRMS= 2.2162 A	1	\$0.05	0603 5 mm ²

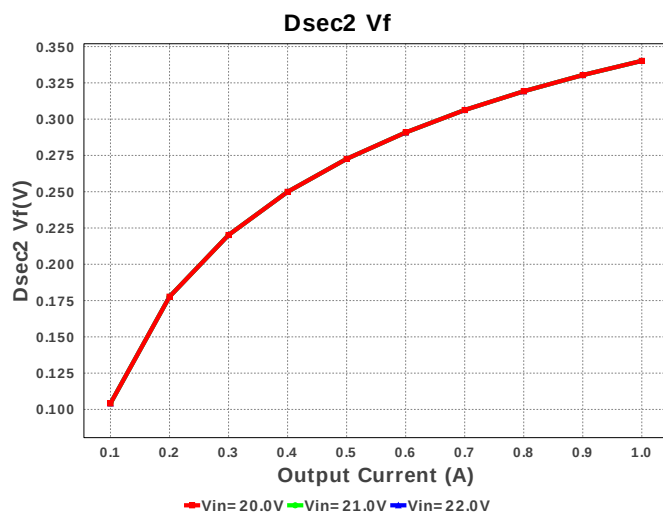
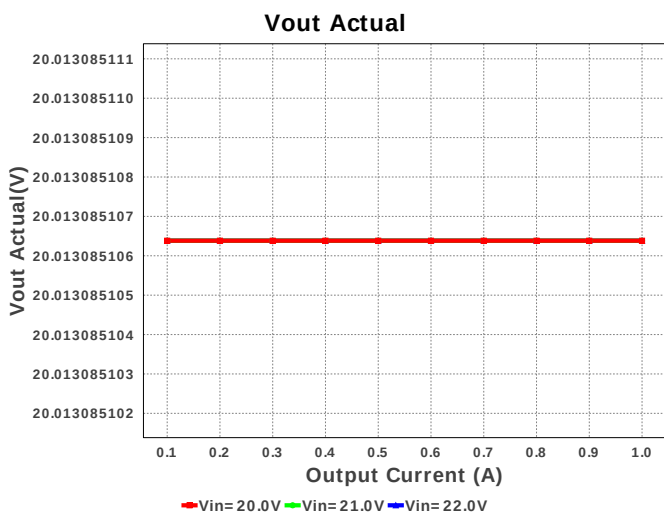
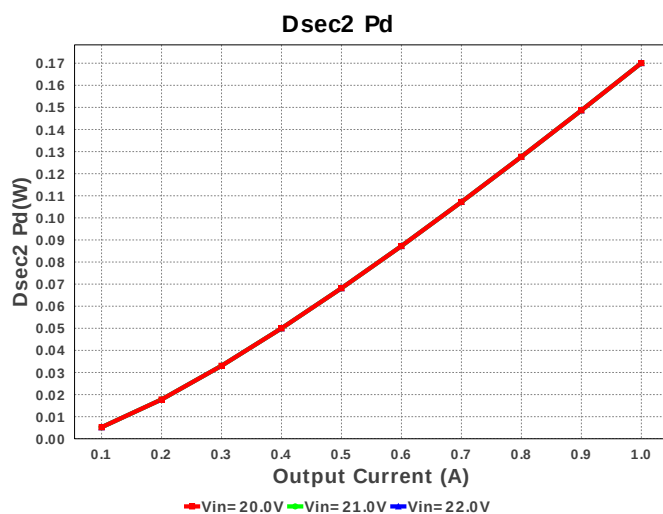
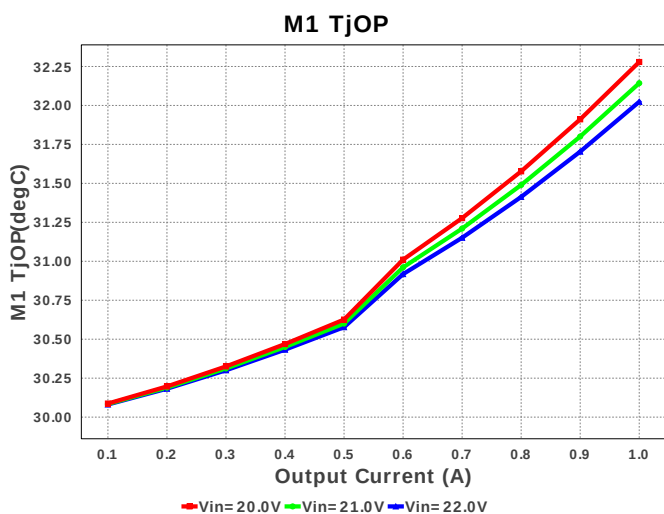
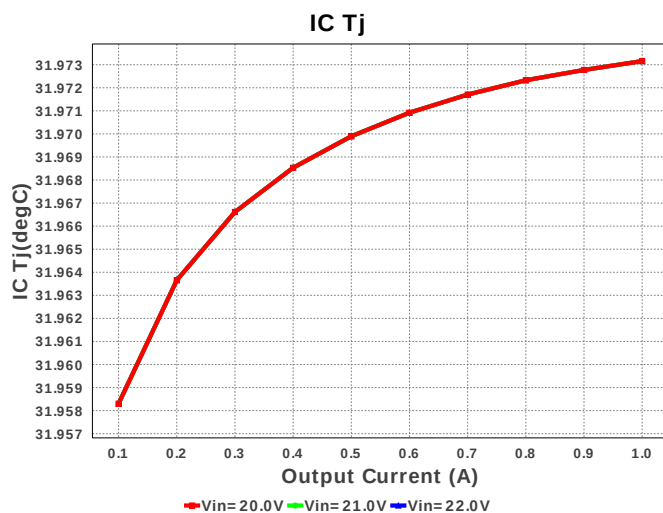
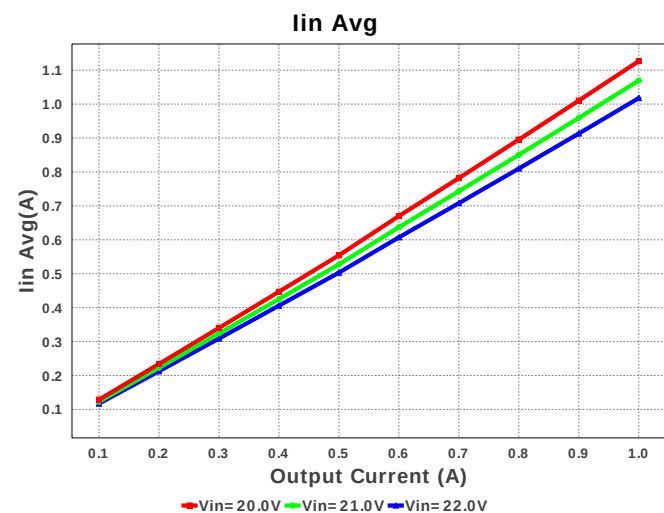
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Cout1	Panasonic	EEV-FK1H331Q Series= FK	Cap= 330.0 uF ESR= 120.0 mOhm VDC= 50.0 V IRMS= 900.0 mA	2	\$0.48	 SM_RADIAL_H13 264 mm ²
9.	Cout2	Panasonic	EEHZA1H101P Series= ?	Cap= 100.0 uF ESR= 28.0 mOhm VDC= 50.0 V IRMS= 2.0 A	2	\$2.54	 SM_RADIAL_10BMM 160 mm ²
10.	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
11.	Csc	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
12.	Csnub	MuRata	GRM31CR72A105KA01L Series= X7R	Cap= 1.0 uF ESR= 5.334 mOhm VDC= 100.0 V IRMS= 1.55432 A	1	\$0.11	 1206_190 11 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.	MMSZ5248B-7-F	Zener	1	\$0.04	 SOD-123 13 mm ²
16.	D21	Vishay-Semiconductor	BYS10-45-E3/TR	VF@Io= 500.0 mV VRRM= 45.0 V	1	\$0.10	 SMA 37 mm ²
17.	Daux	Bourns	CD0603-B0240	VF@Io= 550.0 mV VRRM= 45.0 V	1	\$0.10	 Diode_0603 5 mm ²
18.	Dsec	Micro Commercial Components	SK310A-TP	VF@Io= 850.0 mV VRRM= 100.0 V	1	\$0.10	 SMA 37 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	Vishay-Semiconductor	SS2PH10-M3	VF@Io= 620.0 mV VRRM= 100.0 V	1	\$0.14	 DO-220AA 14 mm ²
21.	Dz	Diodes Inc.	MMSZ5248B-7-F	Zener	1	\$0.04	 SOD-123 13 mm ²
22.	L2	Coilcraft	SER1590-152MLB	L= 1.5 uH DCR= 1.1 mOhm	1	\$1.12	 SER1590 324 mm ²

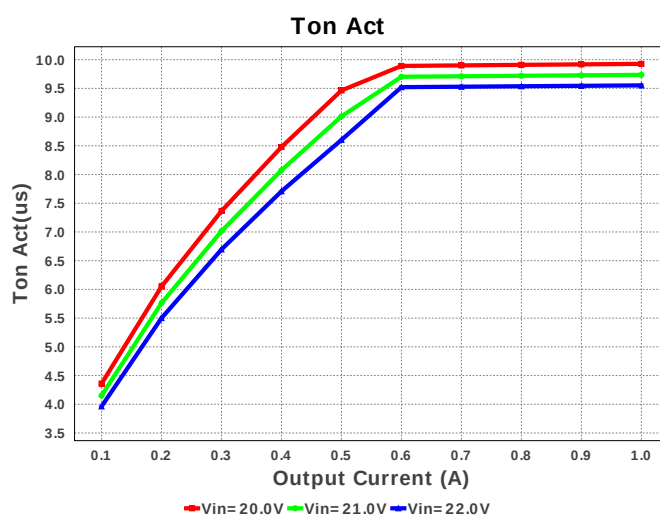
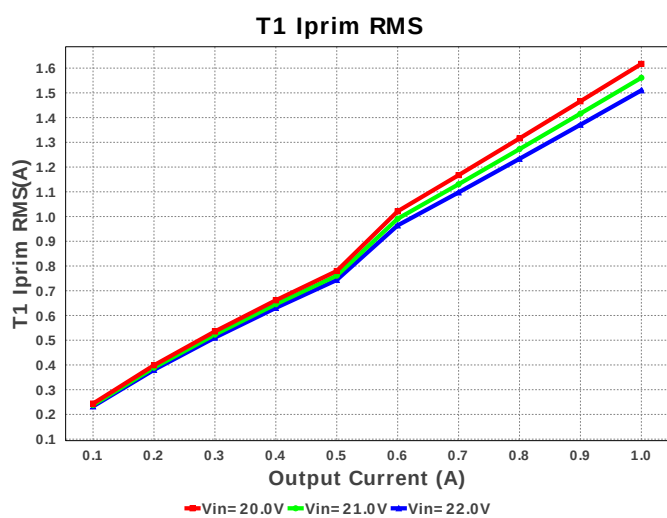
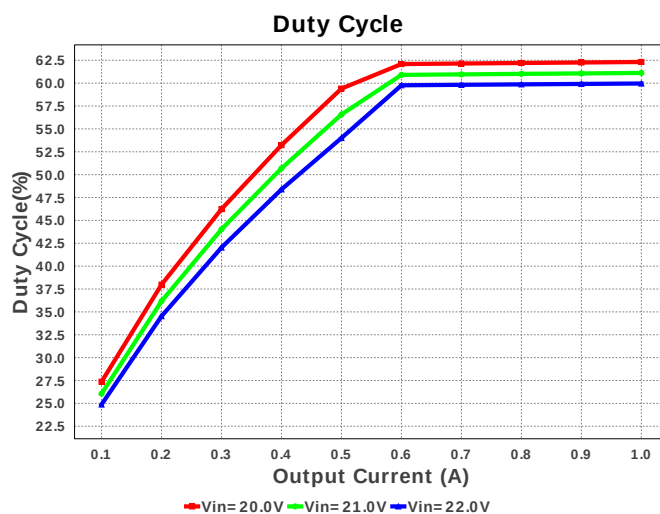
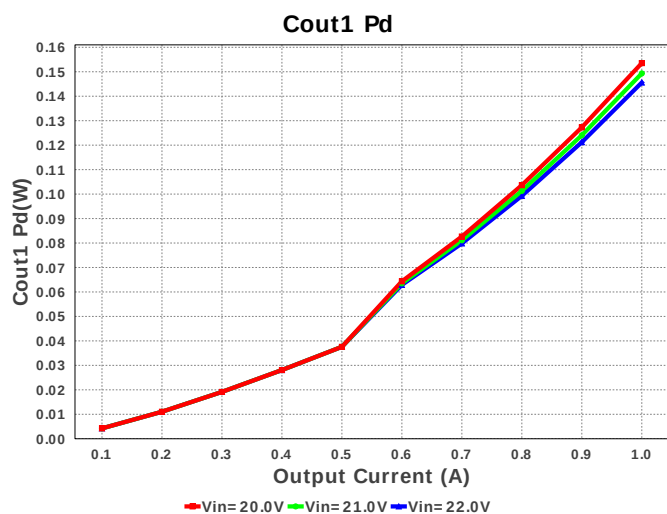
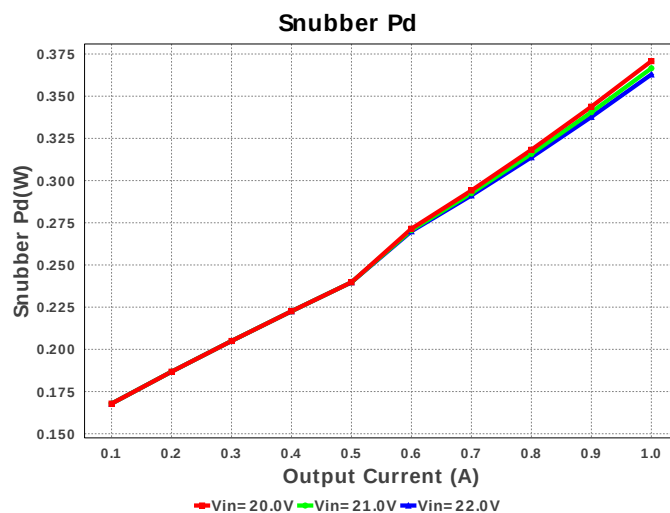
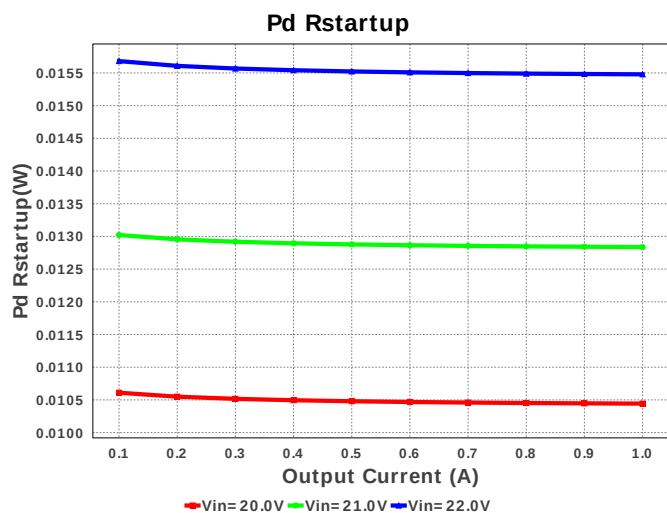
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
23.	M1	Texas Instruments	CSD19534Q5A	VdsMax= 100.0 V IdsMax= 10.0 Amps	1	\$0.68	 TRANS_NexFET_Q5A 55 mm ²
24.	O1	Vishay-Semiconductor	TCMT1107	Optocoupler	1	\$0.21	 SOP-4 44 mm ²
25.	Q1	ON Semiconductor	BC846BLT1G	Bipolar Transistor	1	\$0.02	 SOT-23 14 mm ²
26.	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
27.	R12	Vishay-Dale	CRCW04024K87FKED Series= CRCW..e3	Res= 4.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
28.	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
29.	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
30.	R22	Vishay-Dale	CRCW04021M05FKED Series= CRCW..e3	Res= 1.05 MOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
31.	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
32.	Rbias	Panasonic	ERJ-6ENF1212V Series= ERJ-6E	Res= 12.1 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
33.	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
34.	Rdrv	Vishay-Dale	CRCW08055R36FKEA Series= CRCW..e3	Res= 5.36 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
35.	Rfbb	Yageo America	RC0603FR-074K7L Series= ?	Res= 4.7 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
36.	Rfbt	Yageo America	RC0603FR-0733KL Series= ?	Res= 33.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
37.	Rled	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
38.	Rsc	Vishay-Dale	CRCW040213K7FKED Series= CRCW..e3	Res= 13.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
39.	Rsns	Stackpole Electronics Inc	CSRN2512FKR250 Series= ?	Res= 250.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	\$0.13	 2512 43 mm ²
40.	Rsnub	CUSTOM	CUSTOM Series= ?	Res= 6.2798 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm ²
41.	Rstartup1	Panasonic	ERJ-8ENF1622V Series= ERJ-8E	Res= 16.2 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
42.	Rstartup2	Panasonic	ERJ-8ENF1622V Series= ERJ-8E	Res= 16.2 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²

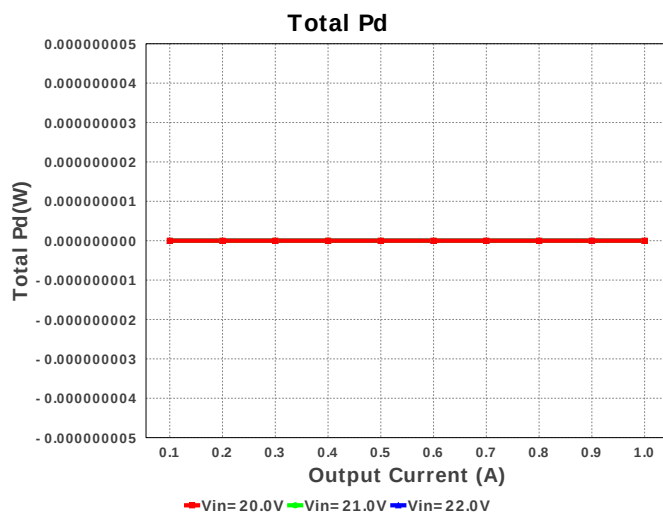
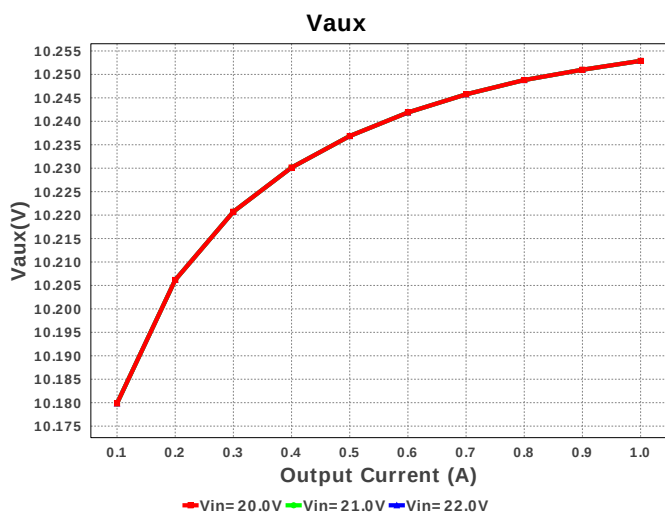
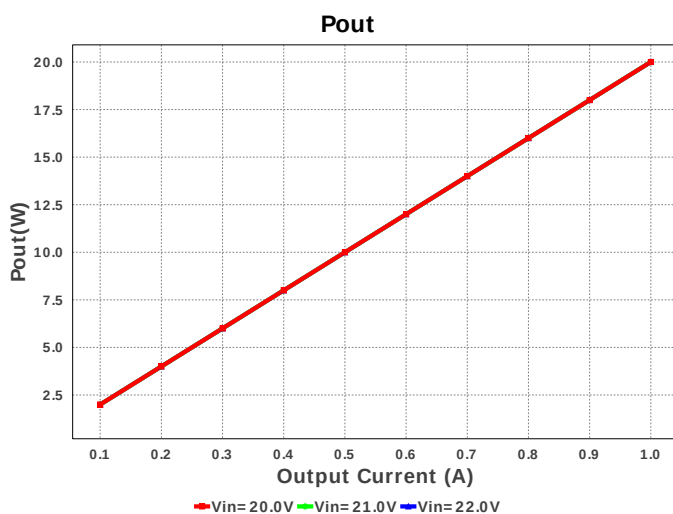
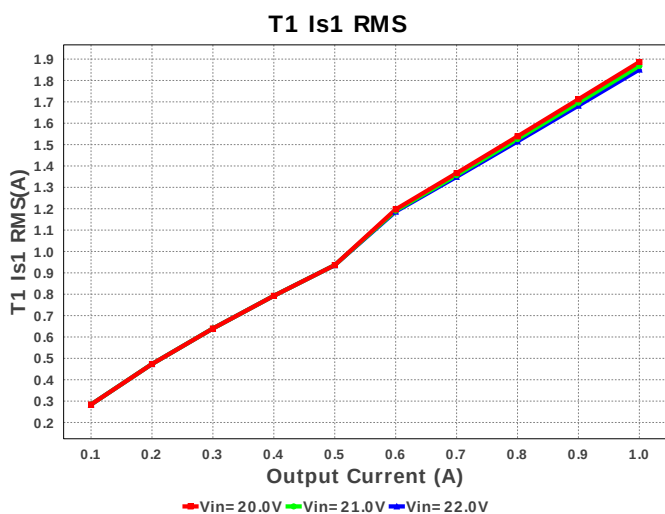
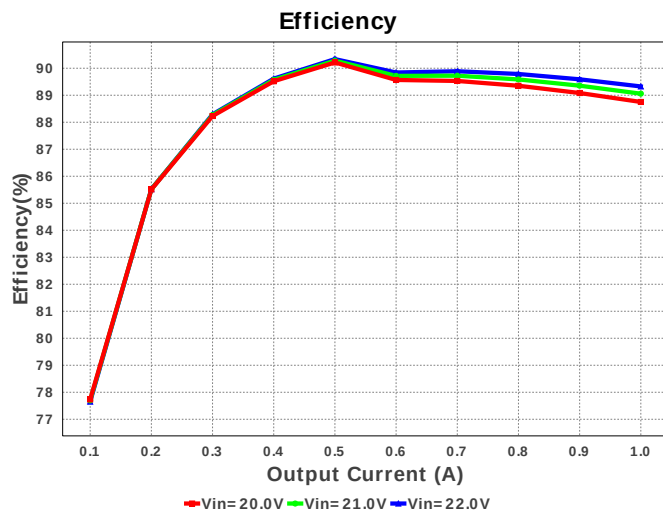
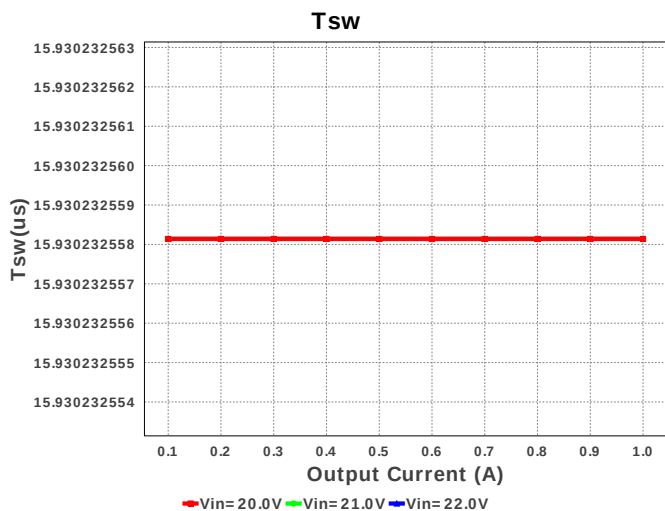
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
43.	Rt	Panasonic	ERJ-6ENF2742V Series= ERJ-6E	Res= 27.4 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
44.	Rz	Vishay-Dale	CRCW04021K10FKED Series= CRCW...e3	Res= 1.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
45.	T1	Würth Elektronik	749196521	Lp= 108.0 µH Rp= 71.1 mOhm Leakage_L= 720.0 nH Ns1toNp= 0.667 Rs1= 142.2 mOhms Ns2toNp= 0.333 Rs2= 71.1 mOhms	1	\$8.80	 EFD20 724 mm ²
46.	U1	Texas Instruments	UCC28C40DR	Switcher	1	\$0.75	 D0008A 57 mm ²
47.	VR	Texas Instruments	TL431AIDBVR	Voltage References	1	\$0.07	 R-PDSO-G3 16 mm ²

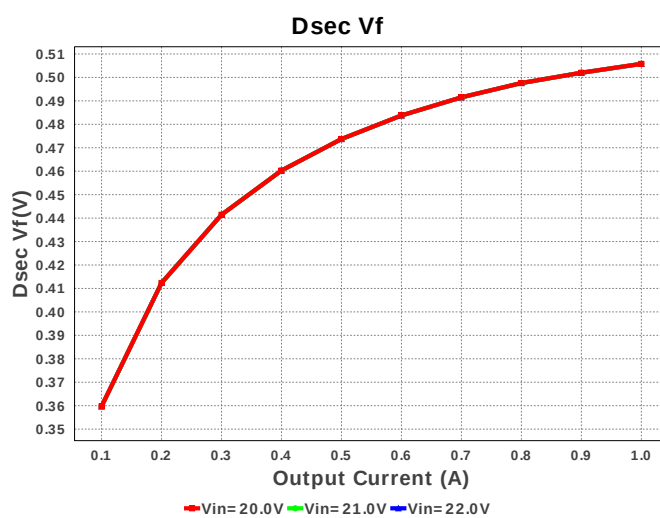
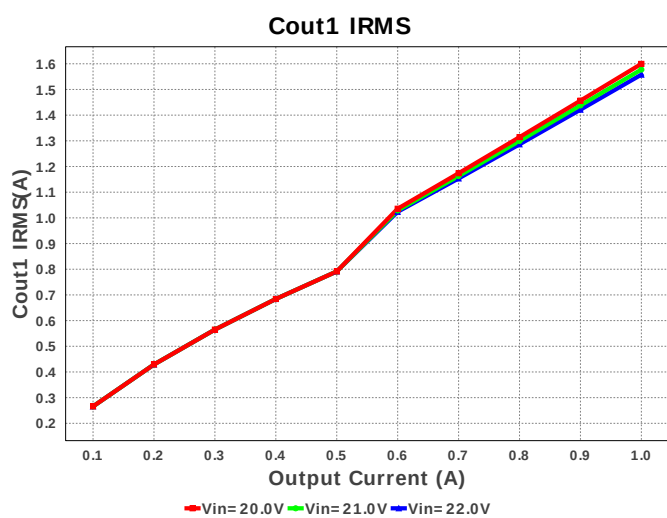
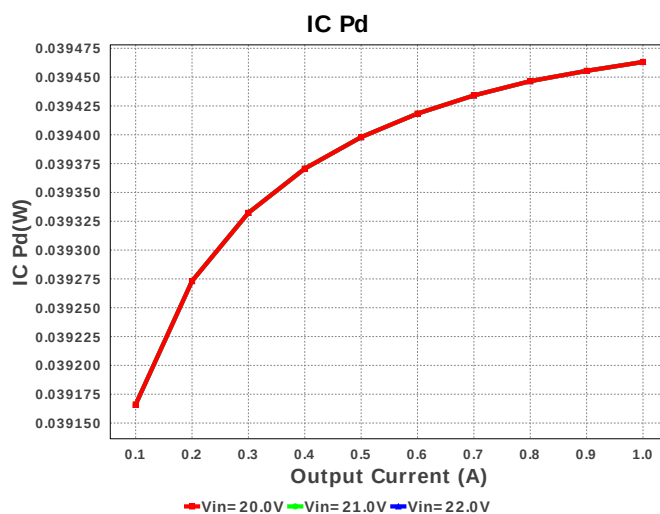
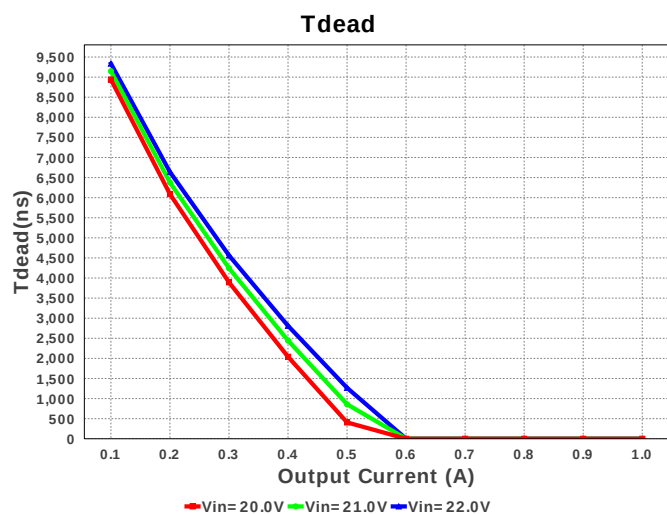
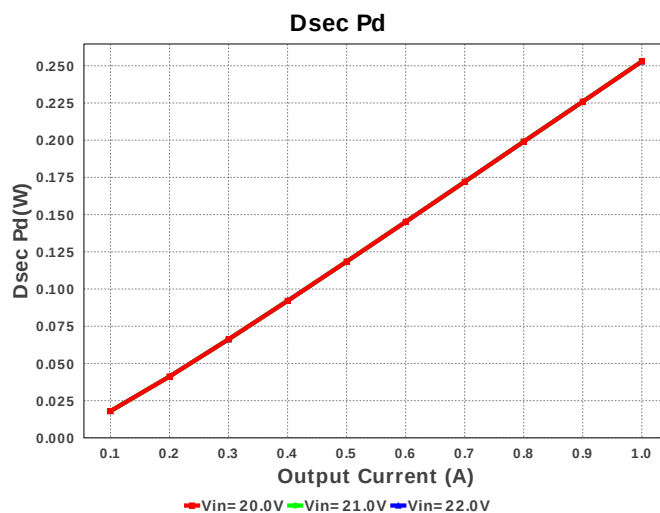
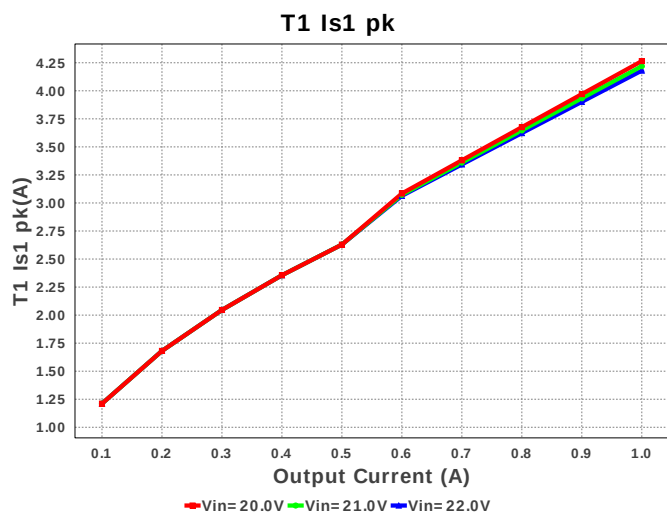


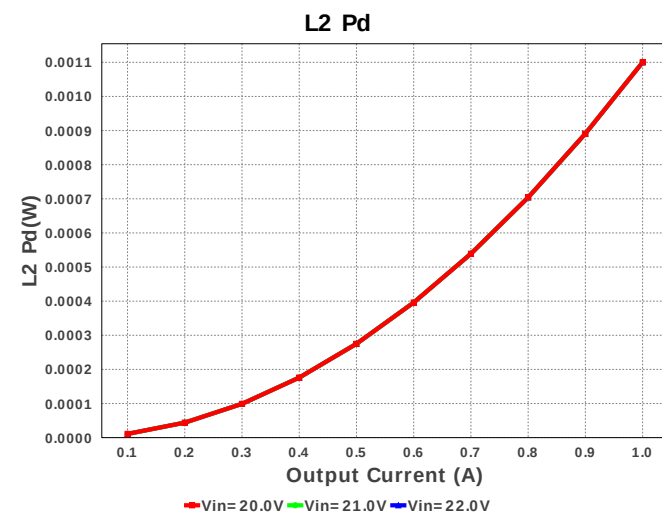
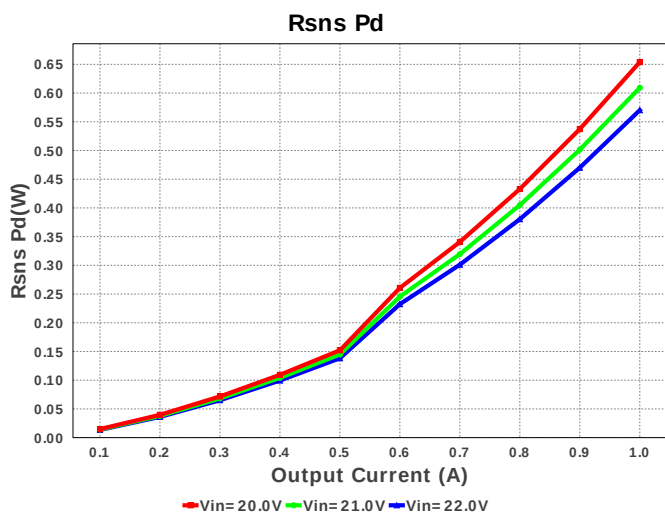
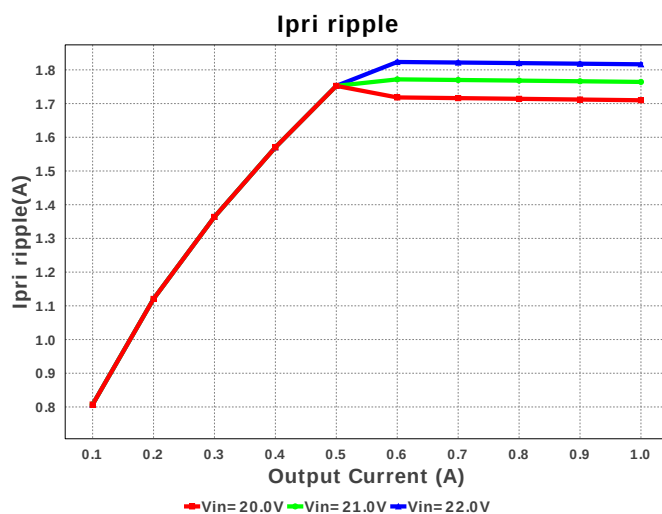
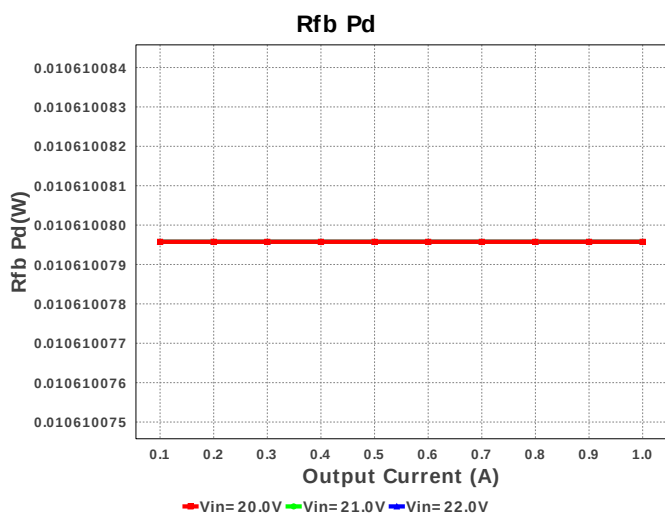
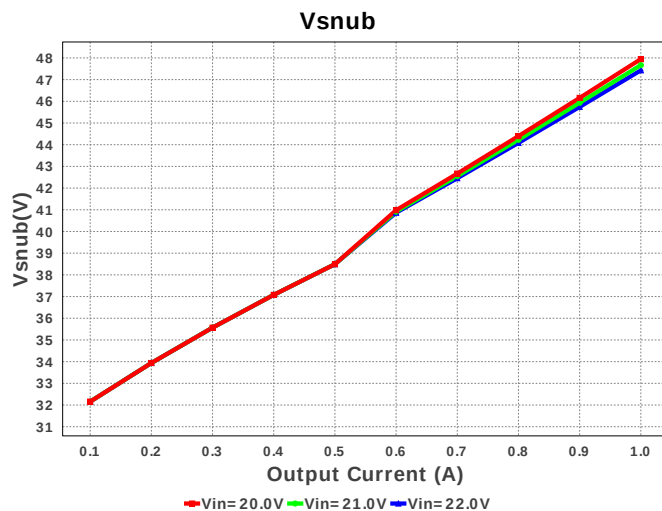
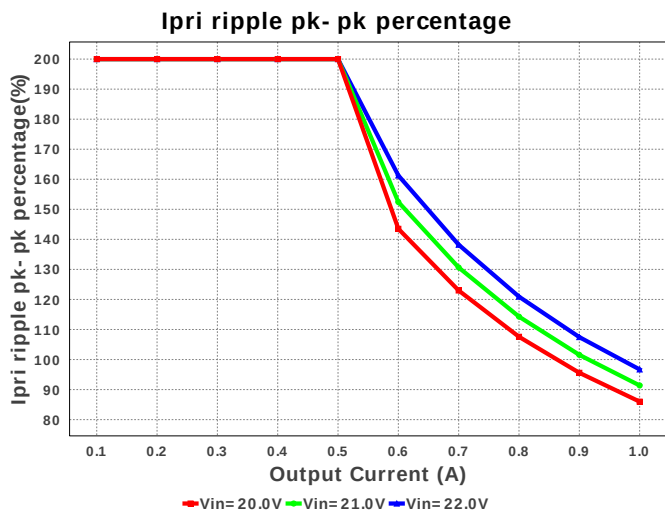


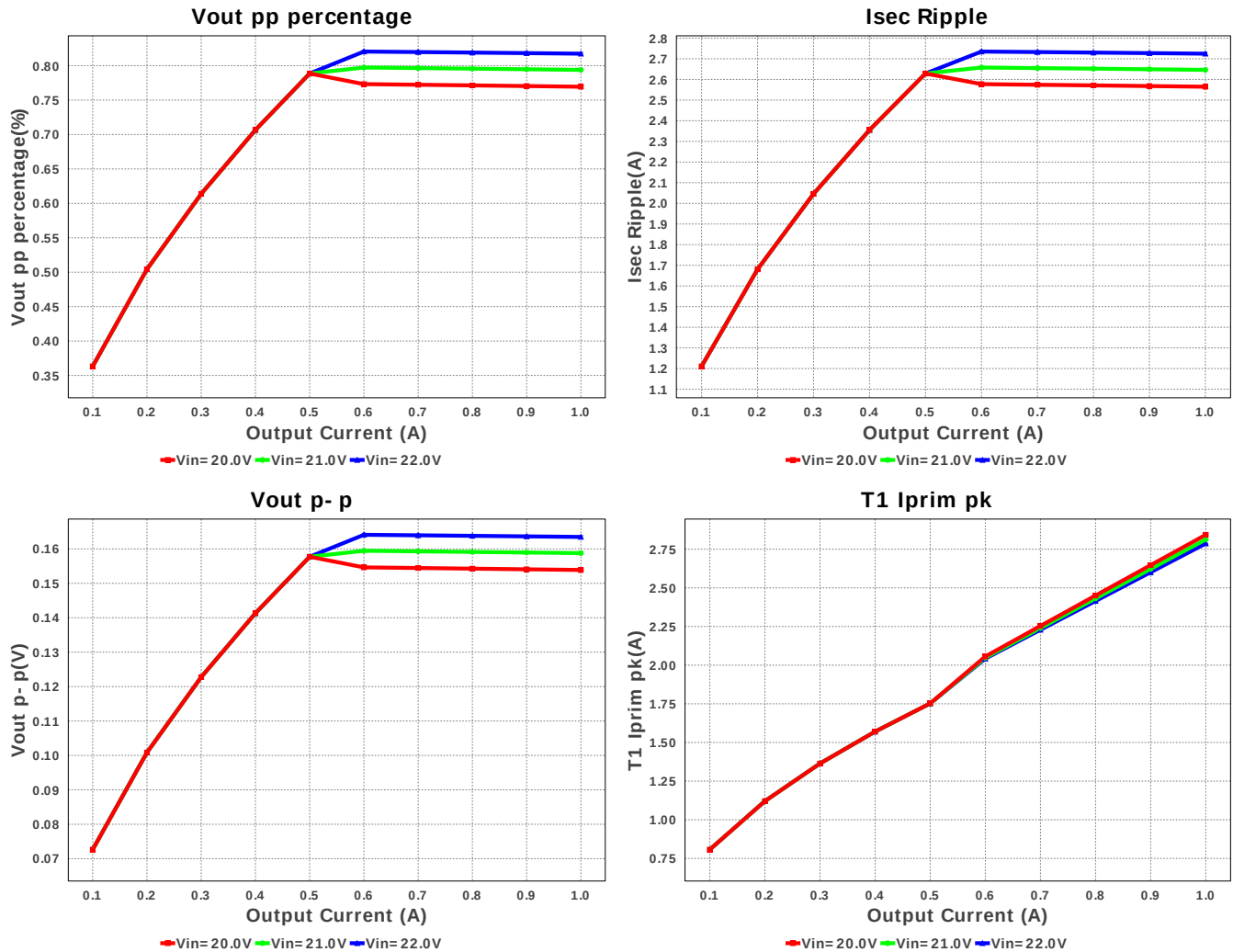












Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	1.6 A	Current	Output capacitor1 RMS ripple current
2.	Iin Avg	1.127 A	Current	Average input current
3.	Iout_DCM	516.911 mA	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	1.239 A	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	1.71 A	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	85.992 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	2.565 A	Current	Ripple Current in the Secondary Winding
8.	T1 Iprim RMS	1.617 A	Current	Transformer Primary RMS Current
9.	T1 Iprim pk	2.843 A	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	1.886 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	4.265 A	Current	Transformer Secondary1 Peak Current
12.	BOM Count	49	General	Total Design BOM count
13.	Daux trr	0.0 ns	General	Auxiliary Diode Reverse Recovery Time
14.	Dsec Vf	505.777 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	340.147 mV	General	Effective Forward Voltage Drop at the Operating Current
17.	Dsnub trr	0.0 ns	General	Snubber Diode Reverse Recovery Time
18.	FootPrint	2.62 k mm ²	General	Total Foot Print Area of BOM components
19.	Frequency	62.774 kHz	General	Switching frequency
20.	Pout	20.0 W	General	Total output power
21.	Tdead	0.0 ns	General	Approximate Dead Time of the Regulator
22.	Toff	5.341 us	General	Approximate Converter Off Time
23.	Ton Act	9.927 us	General	Approximate Converter On Time
24.	Total BOM	\$0.0	General	Total BOM Cost
25.	Tsw	15.93 us	General	Switching Time Period
26.	Vaux	10.253 V	General	Auxiliary Voltage
27.	Vsnub	47.946 V	General	Voltage Across the Snubber
28.	Vout Actual	20.013 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
29.	Vout OP	20.0 V	Op_Point	Operational Output Voltage

#	Name	Value	Category	Description
30.	Duty Cycle	62.314 %	Op_point	Duty cycle
31.	Efficiency	88.751 %	Op_point	Steady state efficiency
32.	IC Tj	31.973 degC	Op_point	IC junction temperature
33.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
34.	IOUT_OP	1.0 A	Op_point	Iout operating point
35.	M1 TjOP	32.279 degC	Op_point	M1 MOSFET junction temperature
36.	Vout p-p	153.883 mV	Op_point	Peak-to-peak output ripple voltage
37.	Cin Pd	11.269 mW	Power	Input capacitor power dissipation
38.	Cout1 Pd	153.531 mW	Power	Output capacitor1 power dissipation
39.	Dsec Pd	252.888 mW	Power	Secondary Diode Power Dissipation
40.	Dsec2 Pd	170.073 mW	Power	Secondary Diode Power Dissipation
41.	IC Pd	39.463 mW	Power	IC power dissipation
42.	L2 Pd	1.1 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
43.	M1 Pd	45.577 mW	Power	M1 MOSFET total power dissipation
44.	Paux	16.85 mW	Power	Power Dissipation in Raux and Daux
45.	Pd Rstartup	10.443 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
46.	Rdrv Pd	6.104 μ W	Power	Power Dissipation in Gate Drive Resistor
47.	Rfb Pd	10.61 mW	Power	Rfb Power Dissipation
48.	Rsns Pd	653.841 mW	Power	Current Limit Sense Resistor Power Dissipation
49.	Snubber Pd	370.797 mW	Power	Snubber Power Dissipation
50.	T1 Pd	1.384 W	Power	Estimated Losses in Transformer
51.	Total Pd	0.0 W	Power	Total Power Dissipation
52.	Vout Tolerance	2.095 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
53.	Vout pp percentage	769.413 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	VinMax	22.0	Maximum input voltage
3.	VinMin	20.0	Minimum input voltage
4.	Vout	20.0	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.

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