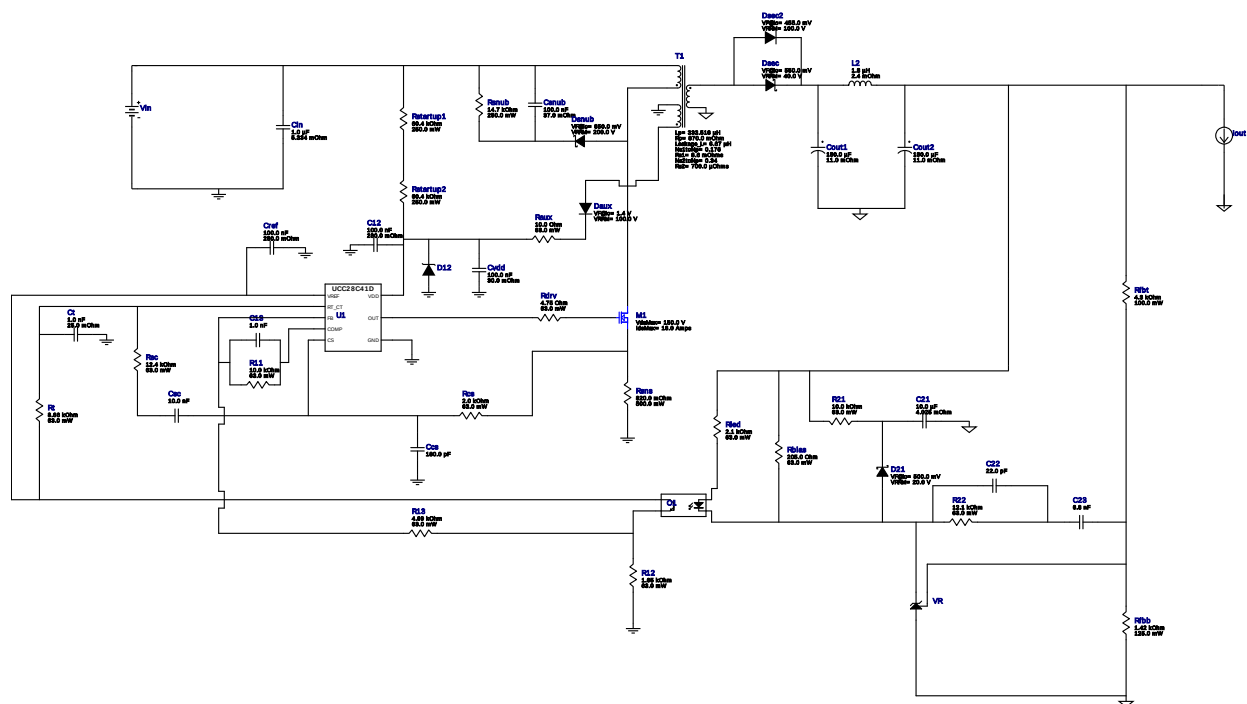


WEBENCH® Design Report

Design : 4762585/9 UCC28C41DR
UCC28C41DR 50.0V-60.0V to 5.00V @ 2.0A

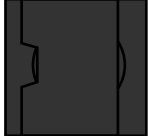
VinMin = 50.0V
VinMax = 60.0V
Vout = 5.0V
Iout = 2.0A

Device = UCC28C41DR
Topology = Flyback
Created = 8/8/16 2:09:15 AM
BOM Cost = \$0.00
BOM Count = 44
Total Pd = 0.0W



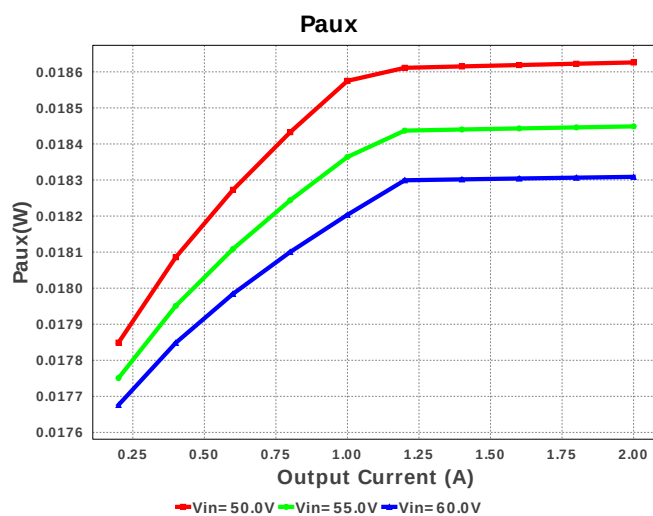
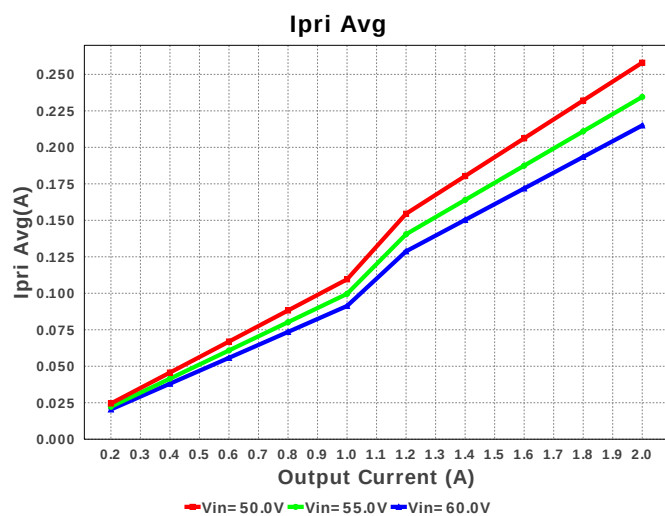
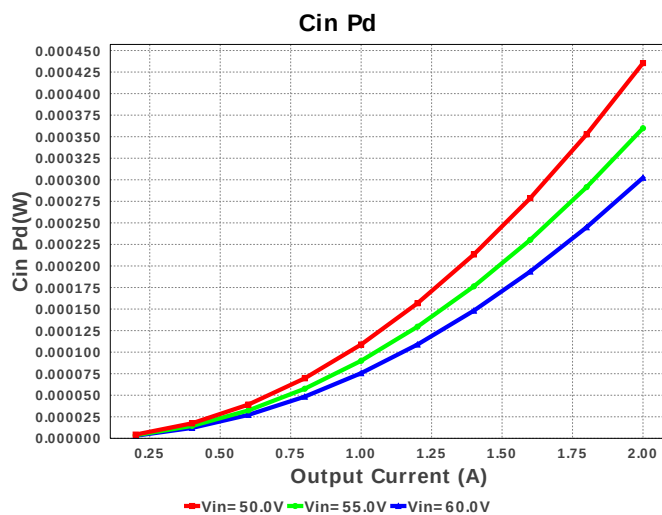
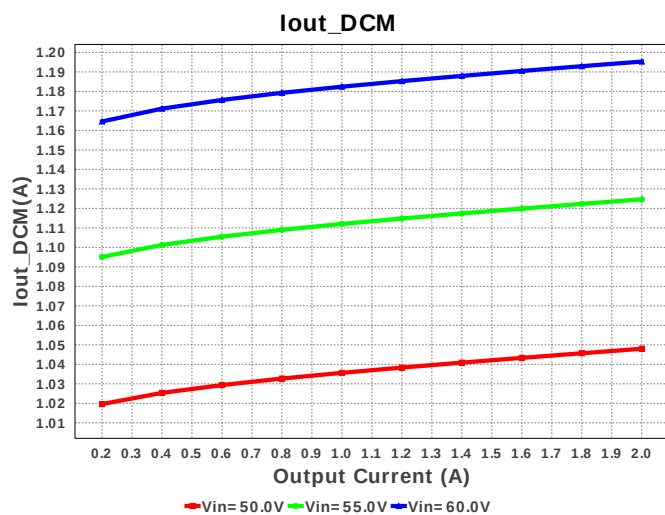
Electrical BOM

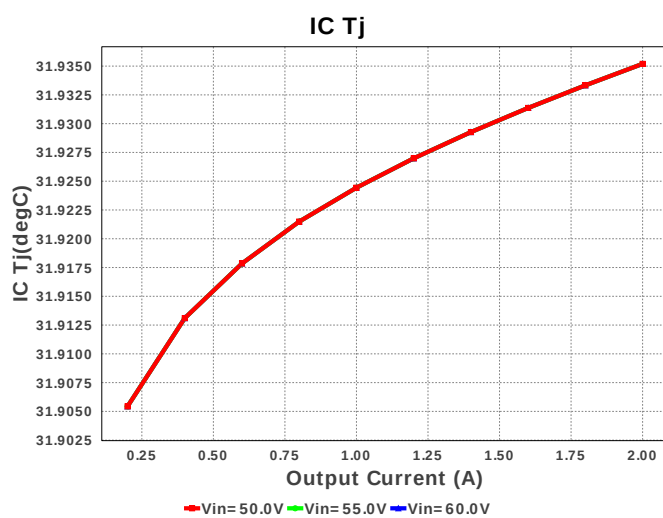
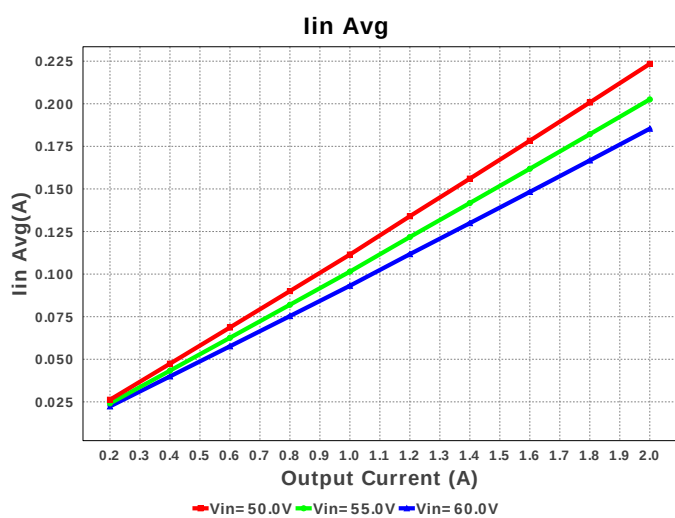
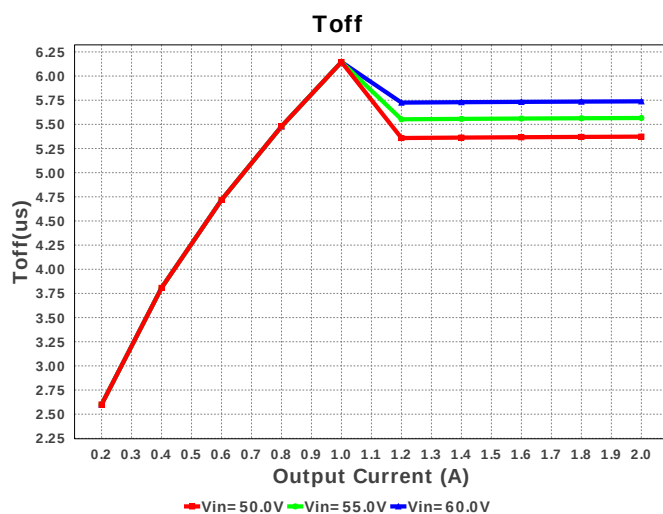
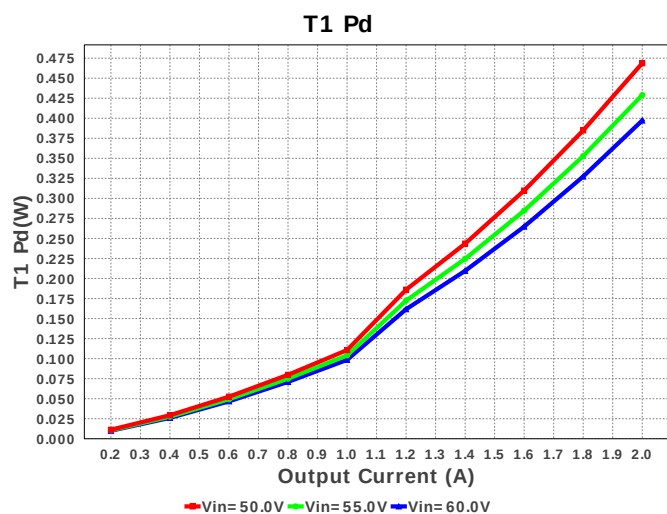
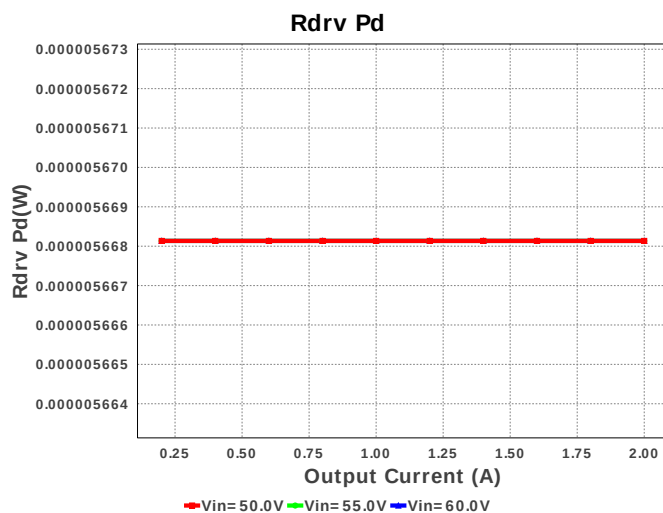
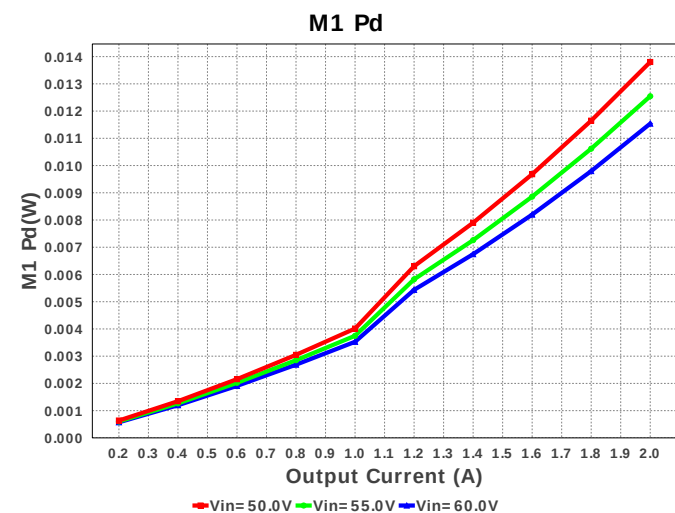
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm²
2.	C13	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm²
3.	C21	MuRata	GRM21BR61A106KE19L Series= X5R	Cap= 10.0 uF ESR= 4.025 mOhm VDC= 10.0 V IRMS= 2.445 A	1	\$0.03	 0805 7 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	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm²
6.	Ccs	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm²
7.	Cin	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 mm²
8.	Cout1	Panasonic	16SVPE180M Series= SVPE	Cap= 180.0 uF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 4.46 A	1	\$0.49	 CAPSMT_62_C10 74 mm²

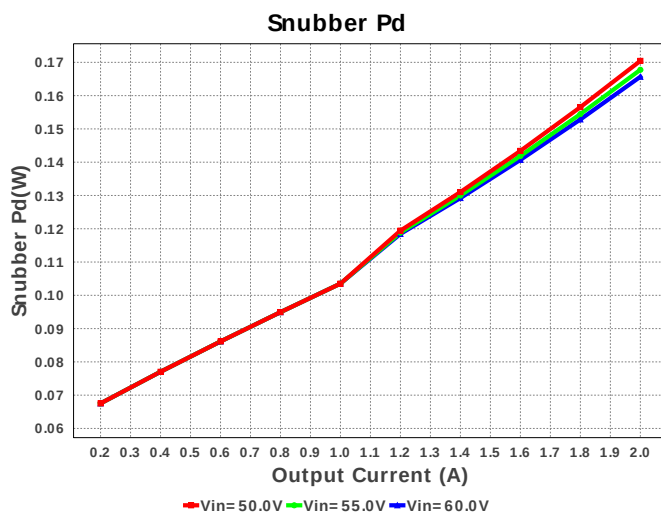
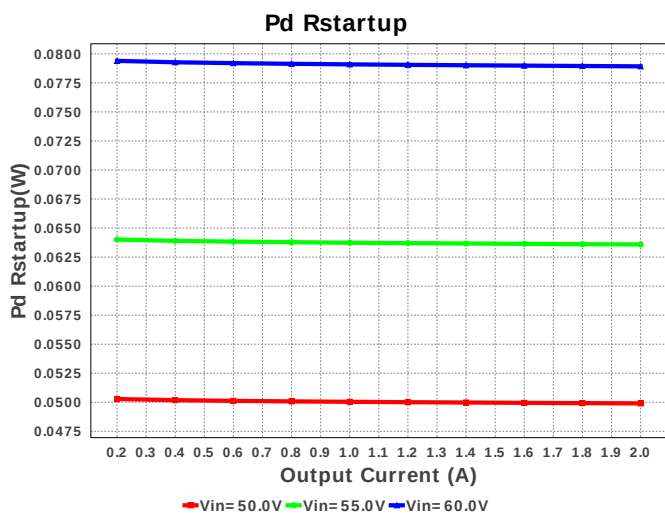
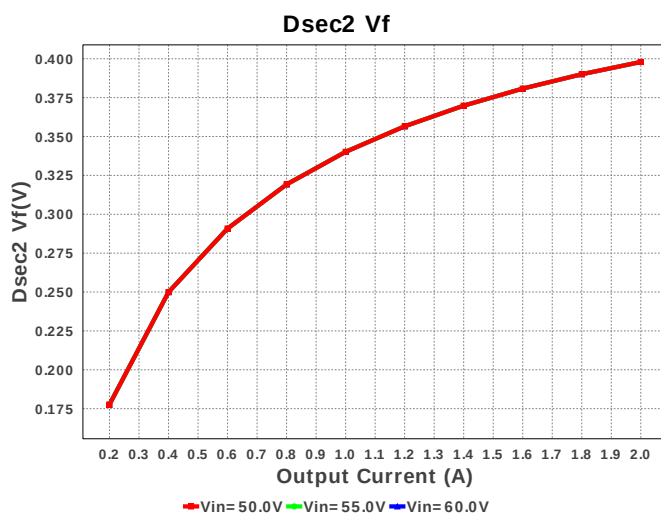
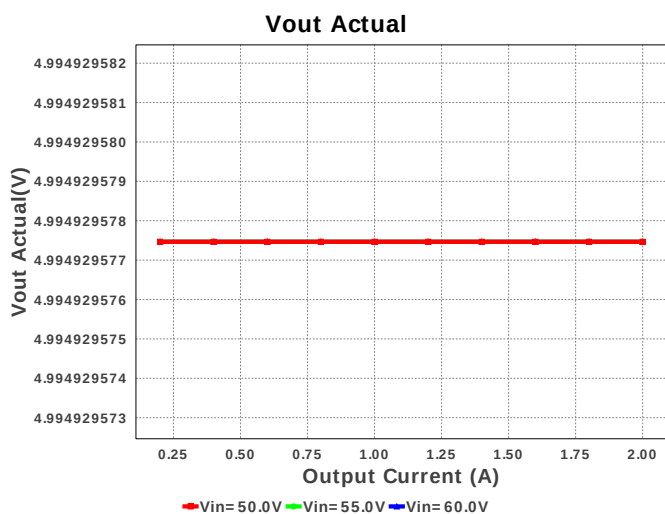
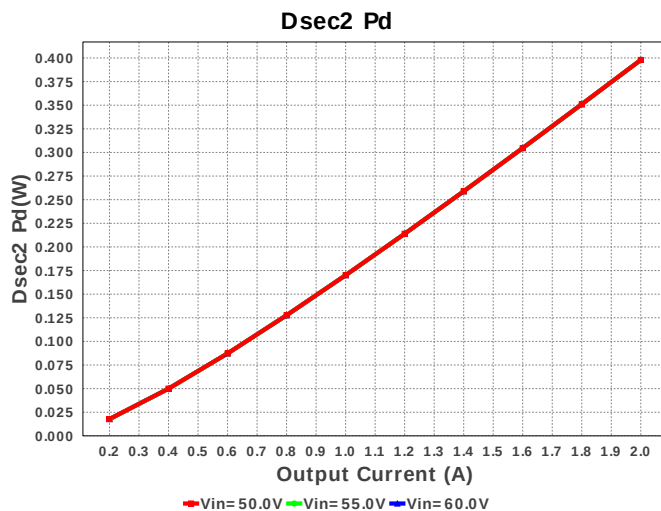
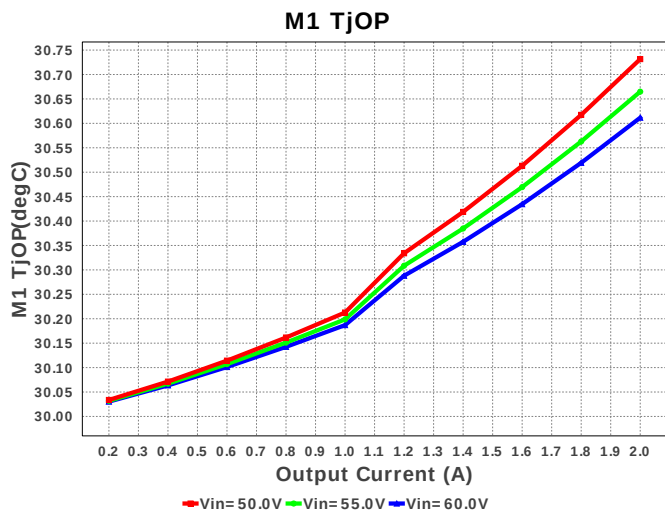
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9.	Cout2	Panasonic	16SVPE180M Series= SVPE	Cap= 180.0 uF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 4.46 A	1	\$0.49	 CAPSMT_62_C10 74 mm ²
10.	Cref	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
11.	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	AVX	12061C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 37.0 mOhm VDC= 100.0 V IRMS= 0.0 A	1	\$0.03	 1206 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	GRM188R71C104KA01D Series= X7R	Cap= 100.0 nF ESR= 30.0 mOhm VDC= 16.0 V IRMS= 1.7 A	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	SS12-E3/61T	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMA 37 mm ²
17.	Daux	NXP Semiconductor	BAS316,115	VF@Io= 1.4 V VRRM= 100.0 V	1	\$0.02	 SOD-323 9 mm ²
18.	Dsec	Diodes Inc.	B540C-13-F	VF@Io= 550.0 mV VRRM= 40.0 V	1	\$0.17	 SMC 83 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	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	\$0.21	 PowerDI123 13 mm ²
21.	L2	Coilcraft	SER1360-182KLB	L= 1.8 uH DCR= 2.4 mOhm	1	\$0.72	 SER1360 225 mm ²
22.	M1	Fairchild Semiconductor	FDMC86240	VdsMax= 150.0 V IdsMax= 16.0 Amps	1	\$0.93	 TRANS_Fairchild_MLP08S 18 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	CRCW04021K65FKED Series= CRCW..e3	Res= 1.65 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

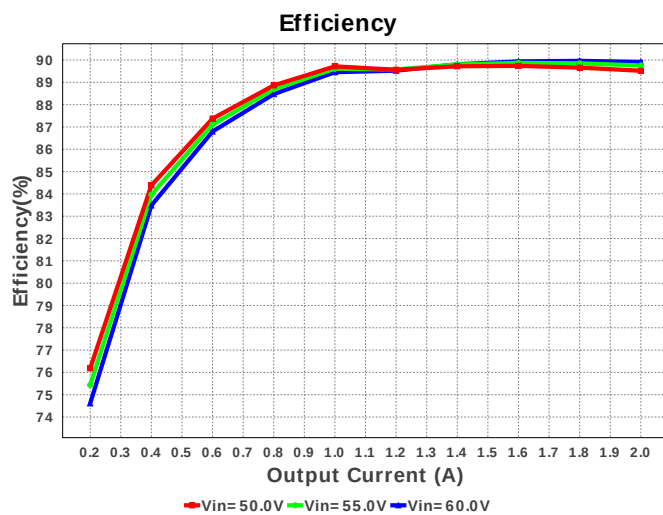
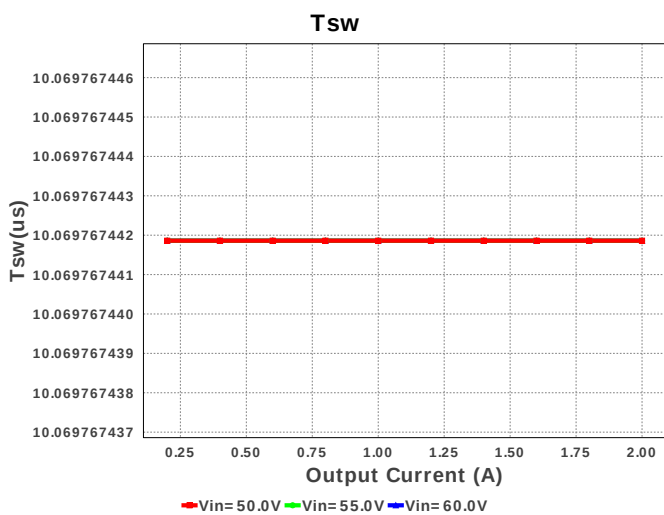
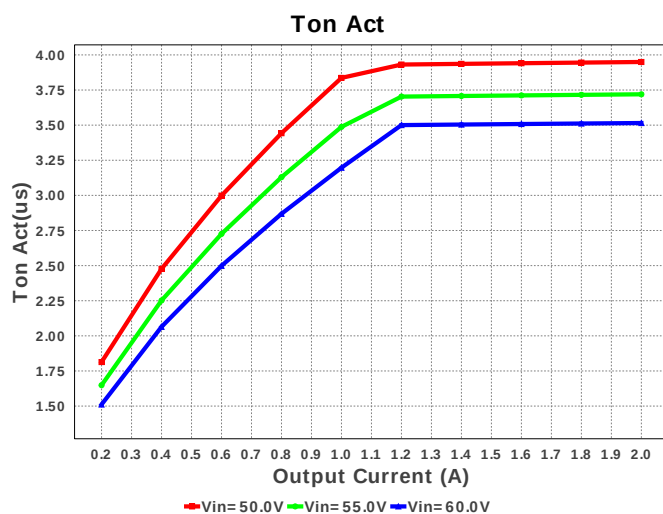
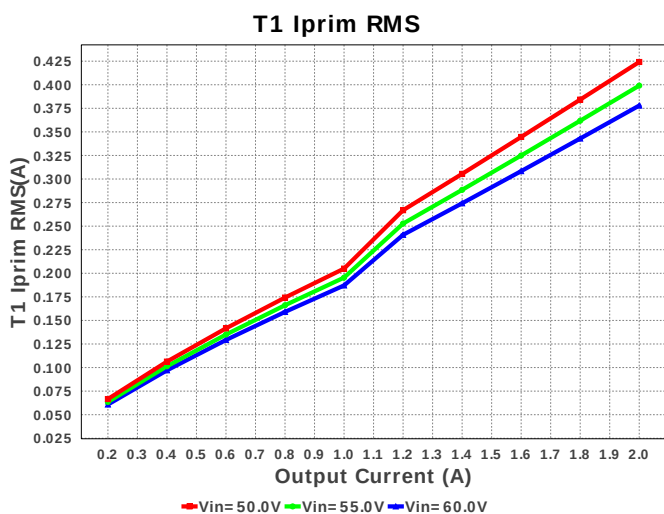
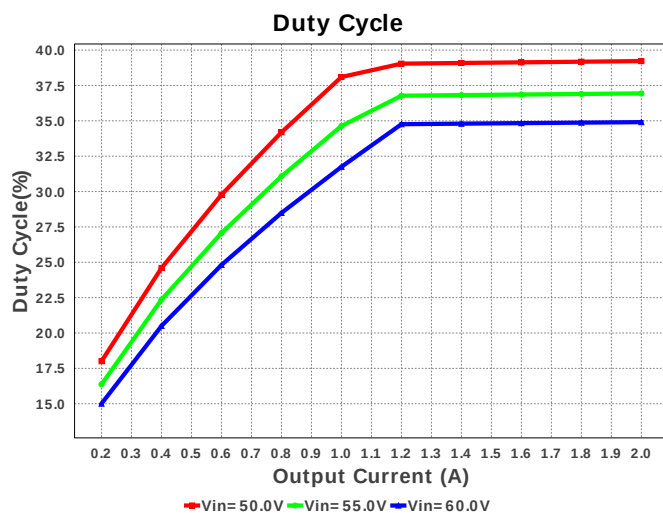
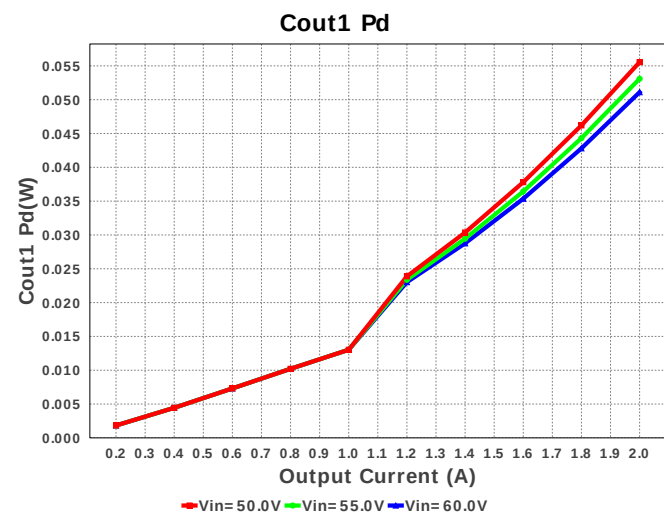
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26.	R13	Vishay-Dale	CRCW04024K99FKED Series= CRCW..e3	Res= 4.99 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
27.	R21	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
28.	R22	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
29.	Raux	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
30.	Rbias	Vishay-Dale	CRCW0402205RFKED Series= CRCW..e3	Res= 205.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
31.	Rcs	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
32.	Rdrv	Vishay-Dale	CRCW04024R75FKED Series= CRCW..e3	Res= 4.75 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
33.	Rfbb	Yageo America	RT0805BRD071K42L Series= RT0805	Res= 1.42 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.05	 0805 7 mm²
34.	Rfbt	Yageo America	RC0603FR-074K3L Series= ?	Res= 4.3 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm²
35.	Rled	Vishay-Dale	CRCW04022K10FKED Series= CRCW..e3	Res= 2.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
36.	Rsc	Vishay-Dale	CRCW040212K4FKED Series= CRCW..e3	Res= 12.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
37.	Rsns	Bourns	CRM1206-FX-R820ELF Series= ?	Res= 820.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.03	 1206 11 mm²
38.	Rsnu	Panasonic	ERJ-8ENF1472V Series= ERJ-8E	Res= 14.7 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
39.	Rstartup1	Panasonic	ERJ-8ENF6042V Series= ERJ-8E	Res= 60.4 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
40.	Rstartup2	Panasonic	ERJ-8ENF6042V Series= ERJ-8E	Res= 60.4 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm²
41.	Rt	Vishay-Dale	CRCW04028K66FKED Series= CRCW..e3	Res= 8.66 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
42.	T1	CUSTOM	CUSTOM	Lp= 333.518 µH Rp= 870.0 mOhm Leakage_L= 6.67 µH Ns1toNp= 0.176 Rs1= 8.6 mOhms Ns2toNp= 0.34 Rs2= 700.0 µOhms	1	NA	CUSTOM 0 mm²
43.	U1	Texas Instruments	UCC28C41DR	Switcher	1	\$0.75	 D0008A 57 mm²

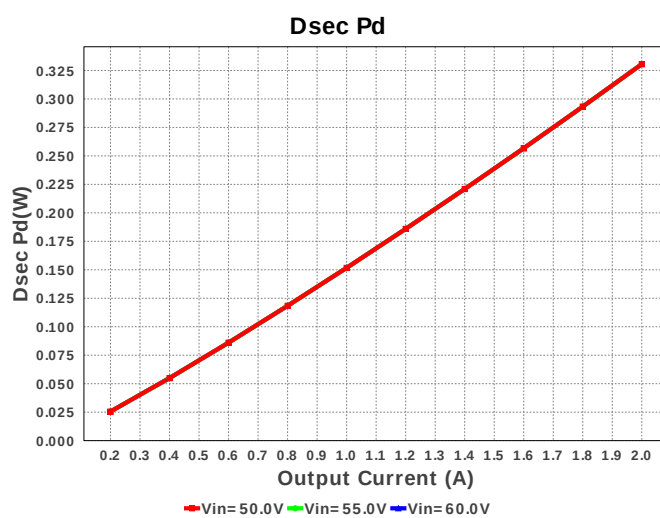
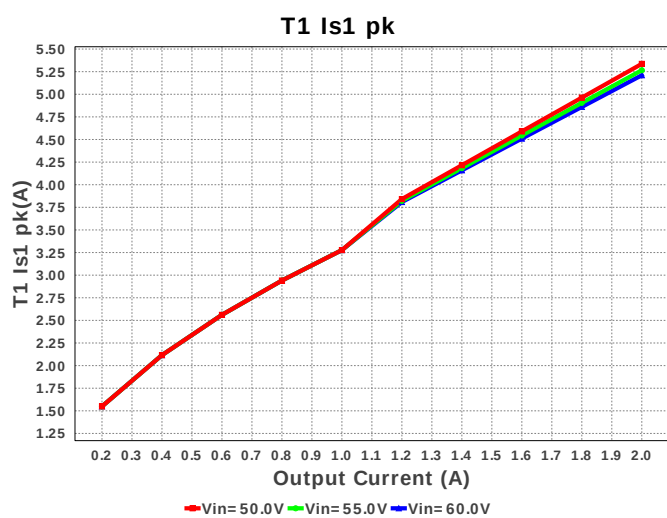
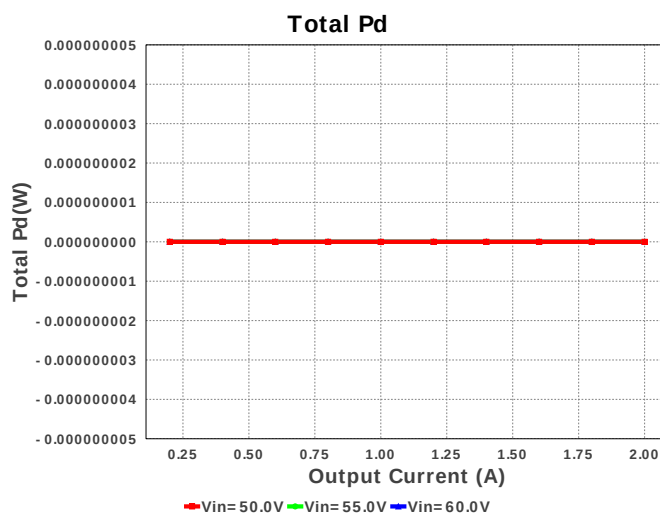
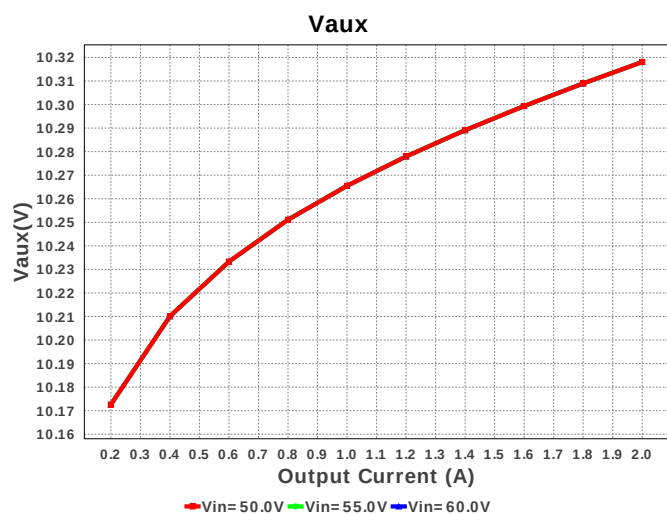
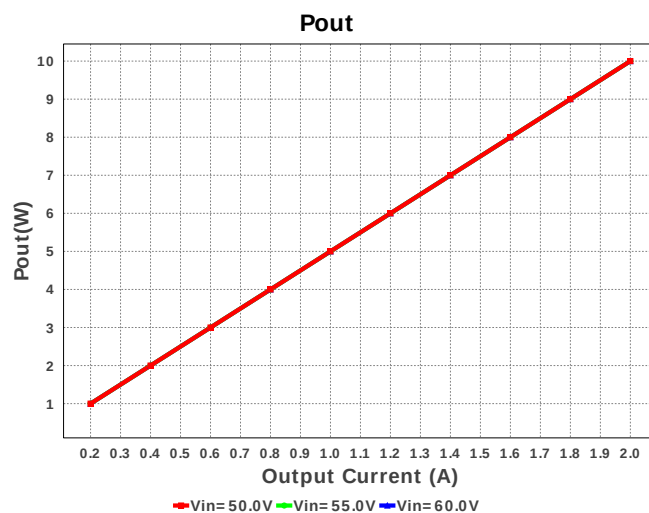
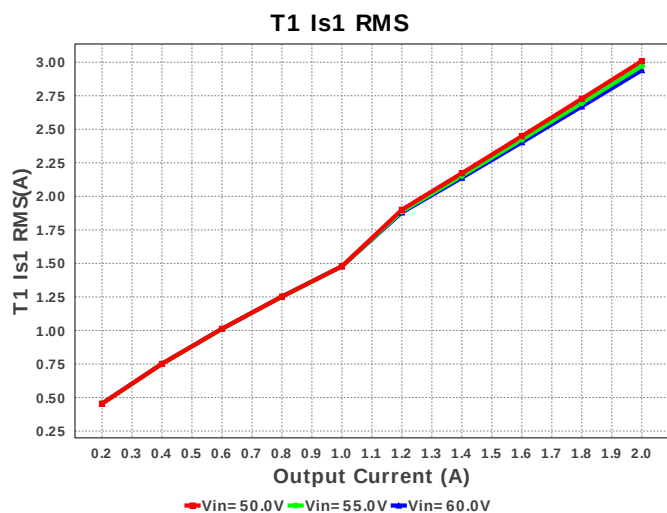
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
44.	VR	Texas Instruments	LMV431CM5/NOPB	Voltage References	1	\$0.16	 R-PDSO-G3 16 mm ²

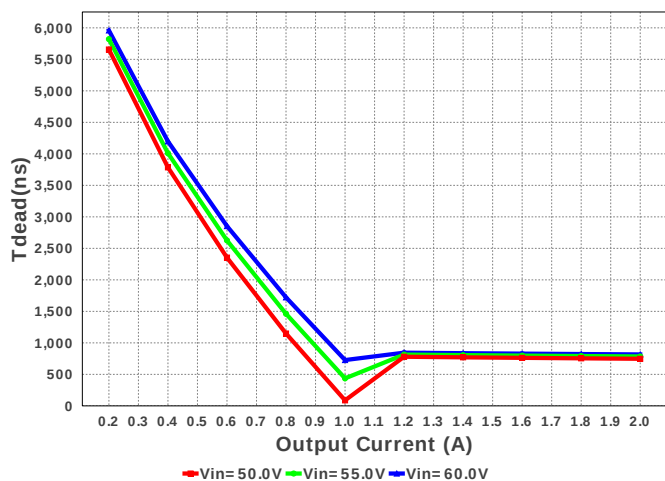
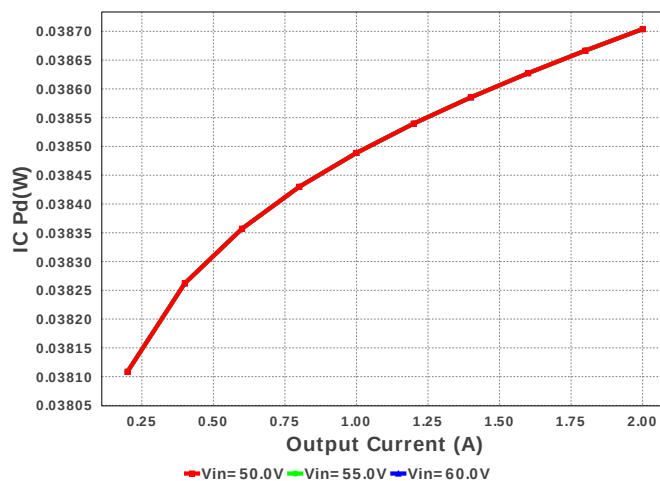
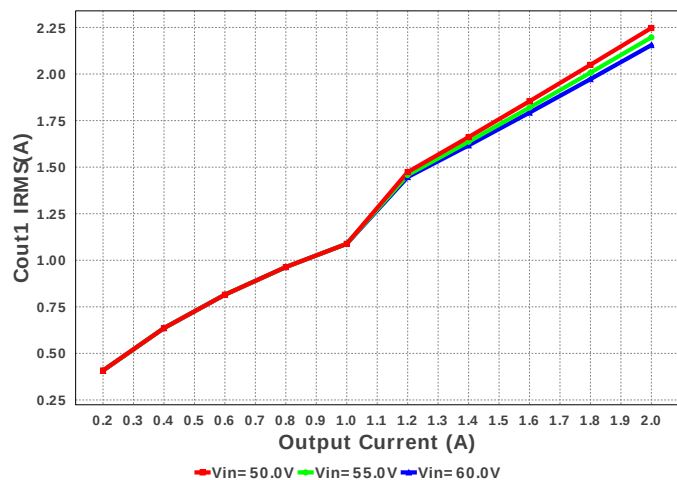
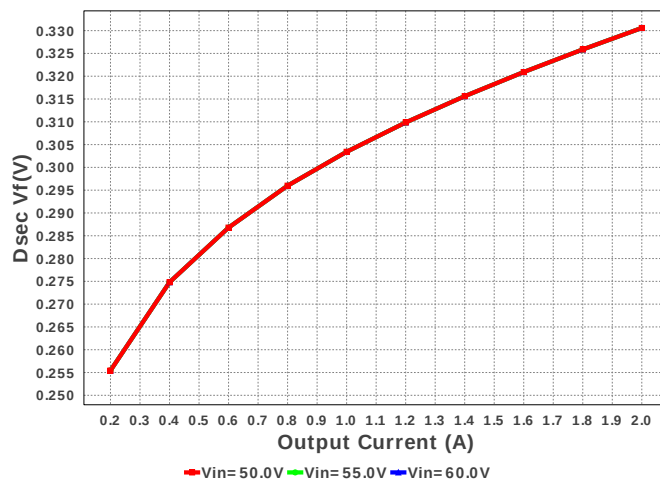
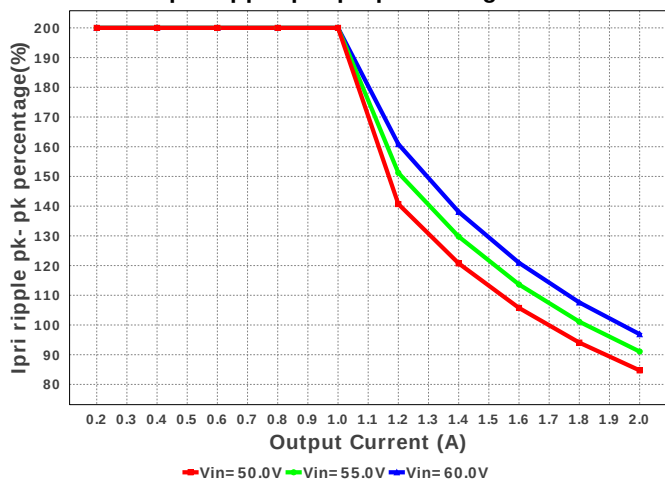
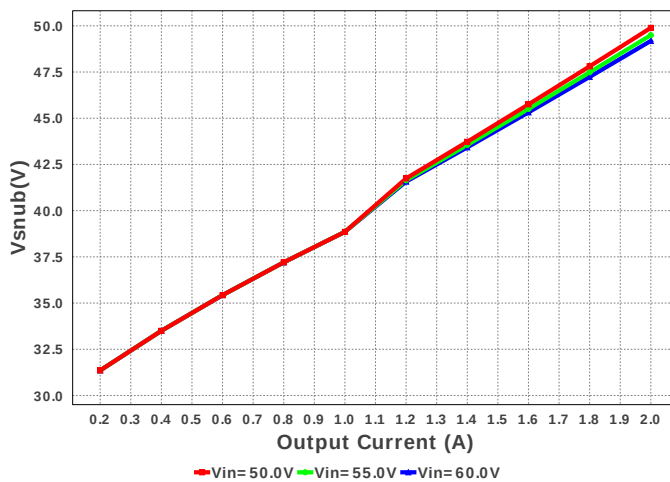


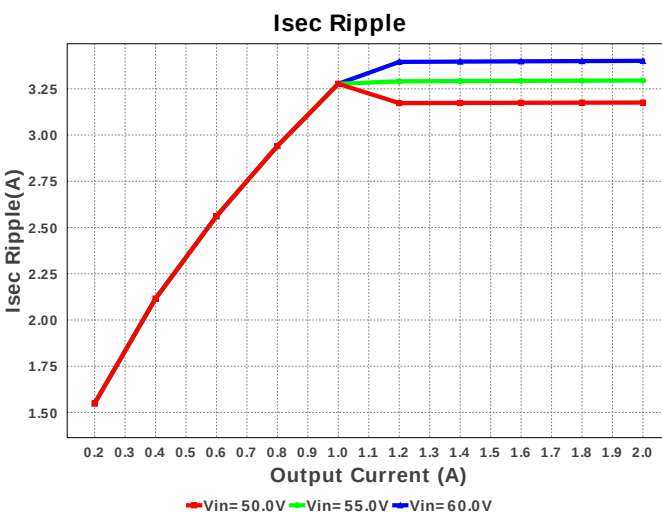
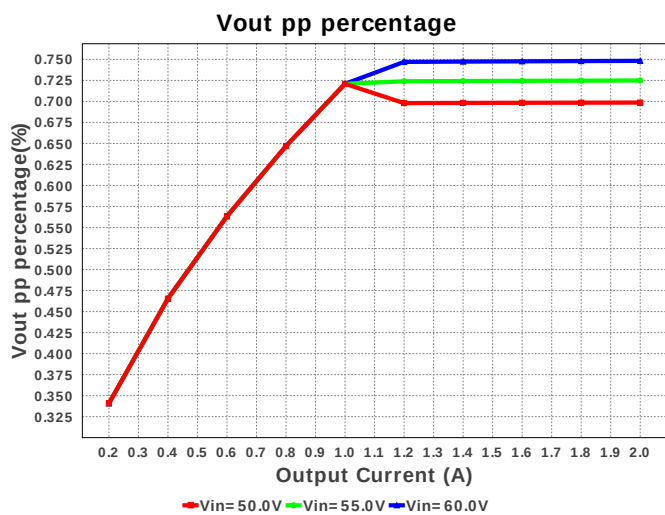
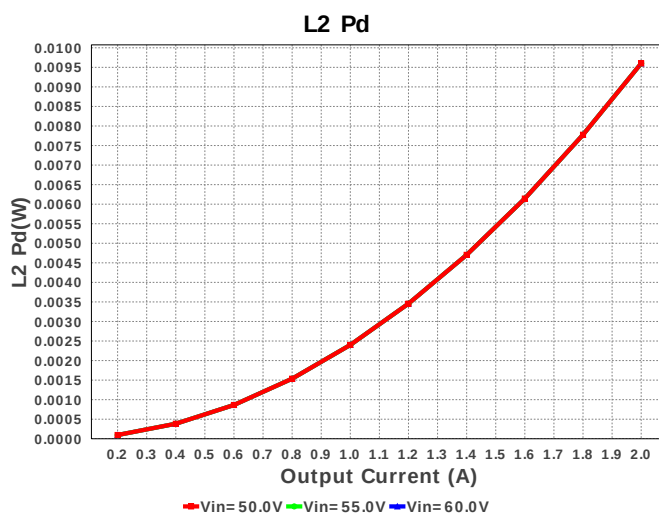
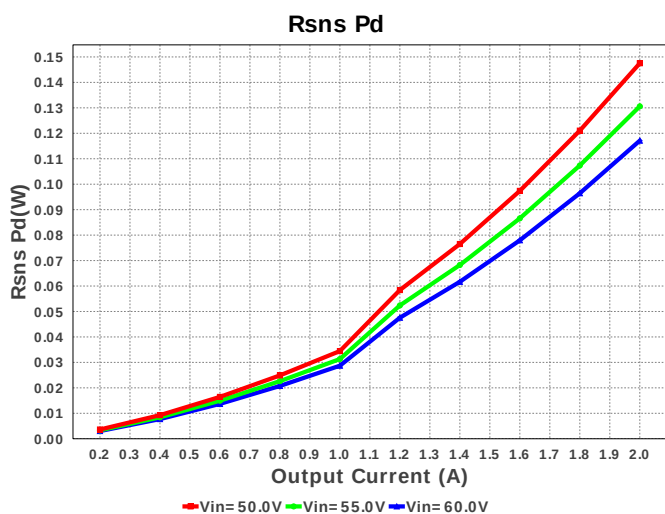
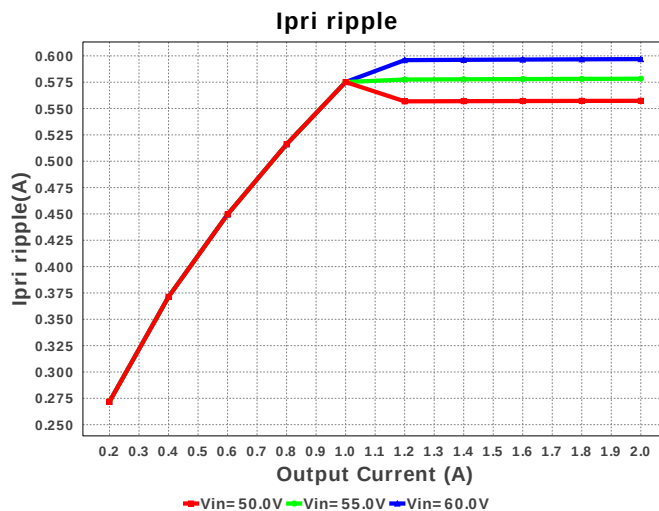
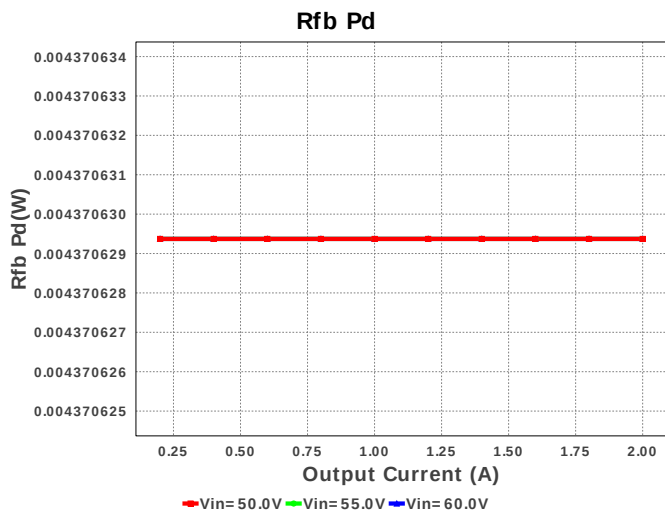


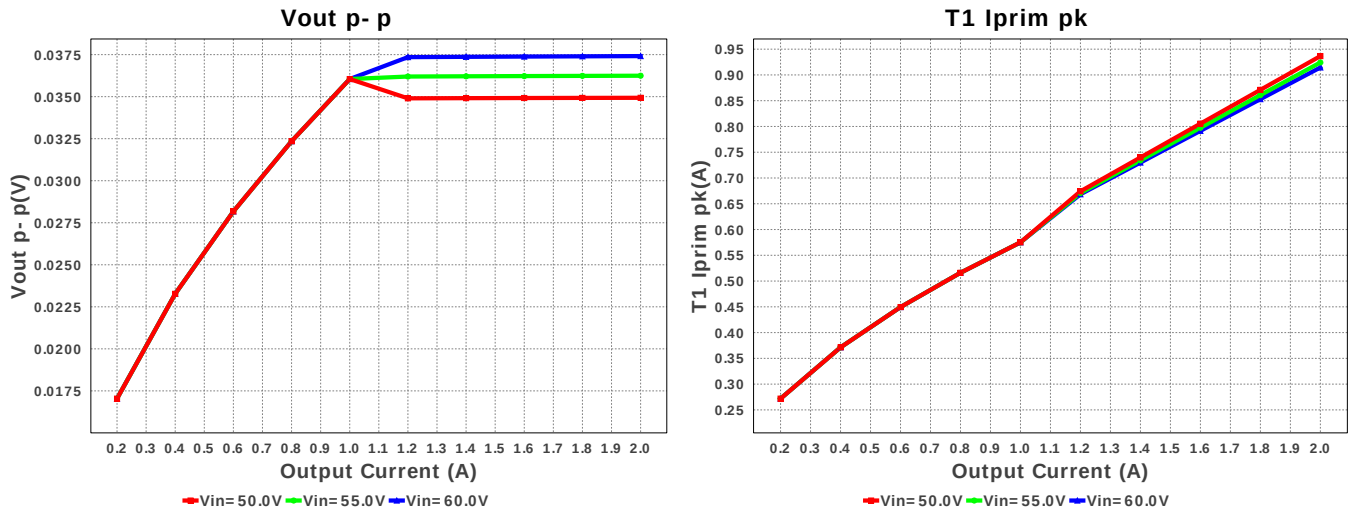






Tdead**IC Pd****Cout1 IRMS****Dsec Vf****Ipri ripple pk- pk percentage****Vsub**





Operating Values

#	Name	Value	Category	Description
1.	Cout1 IRMS	2.247 A	Current	Output capacitor1 RMS ripple current
2.	Iin Avg	223.42 mA	Current	Average input current
3.	Iout_DCM	1.048 A	Current	Approximate Current below which DCM mode of operation will begin
4.	Ipri Avg	258.03 mA	Current	Average Current in Primary Winding over the complete Switching Period
5.	Ipri ripple	557.344 mA	Current	Ripple Current in the Primary Winding
6.	Ipri ripple pk-pk percentage	84.721 %	Current	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
7.	Isec Ripple	3.176 A	Current	Ripple Current in the Secondary Winding
8.	T1 lprim RMS	424.148 mA	Current	Transformer Primary RMS Current
9.	T1 lprim pk	936.534 mA	Current	Transformer Primary Peak Current
10.	T1 Is1 RMS	3.008 A	Current	Transformer Secondary1 RMS Current
11.	T1 Is1 pk	5.336 A	Current	Transformer Secondary1 Peak Current
12.	BOM Count	44	General	Total Design BOM count
13.	Daux trr	4.0 ns	General	Auxiliary Diode Reverse Recovery Time
14.	Dsec Vf	330.58 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	0.0 ns	General	Snubber Diode Reverse Recovery Time
18.	FootPrint	1.057 k mm ²	General	Total Foot Print Area of BOM components
19.	Frequency	99.307 kHz	General	Switching frequency
20.	Pout	10.0 W	General	Total output power
21.	Tdead	747.256 ns	General	Approximate Dead Time of the Regulator
22.	Toff	5.373 us	General	Approximate Converter Off Time
23.	Ton Act	3.95 us	General	Approximate Converter On Time
24.	Total BOM	\$0.0	General	Total BOM Cost
25.	Tsw	10.07 us	General	Switching Time Period
26.	Vaux	10.318 V	General	Auxiliary Voltage
27.	Vsnub	49.888 V	General	Voltage Across the Snubber
28.	Vout Actual	4.995 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
29.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
30.	Duty Cycle	39.223 %	Op_point	Duty cycle
31.	Efficiency	89.517 %	Op_point	Steady state efficiency
32.	IC Tj	31.935 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	30.732 degC	Op_point	M1 MOSFET junction temperature
36.	Vout p-p	34.932 mV	Op_point	Peak-to-peak output ripple voltage
37.	Cin Pd	435.429 μW	Power	Input capacitor power dissipation
38.	Cout1 Pd	55.551 mW	Power	Output capacitor1 power dissipation
39.	Dsec Pd	330.58 mW	Power	Secondary Diode Power Dissipation
40.	Dsec2 Pd	397.923 mW	Power	Secondary Diode Power Dissipation
41.	IC Pd	38.704 mW	Power	IC power dissipation
42.	L2 Pd	9.6 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
43.	M1 Pd	13.802 mW	Power	M1 MOSFET total power dissipation
44.	Paux	18.626 mW	Power	Power Dissipation in Raux and Daux
45.	Pd Rstartup	49.904 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
46.	Rdrv Pd	5.668 μW	Power	Power Dissipation in Gate Drive Resistor
47.	Rfb Pd	4.371 mW	Power	Rfb Power Dissipation
48.	Rsns Pd	147.519 mW	Power	Current Limit Sense Resistor Power Dissipation
49.	Snubber Pd	170.444 mW	Power	Snubber Power Dissipation
50.	T1 Pd	468.69 mW	Power	Estimated Losses in Transformer

#	Name	Value	Category	Description
51.	Total Pd	0.0 W	Power	Total Power Dissipation
52.	Vout Tolerance	1.478 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
53.	Vout pp percentage	698.639 m%		Output Voltage ripple percentage

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	Iout1	2.0	Output Current #1
3.	Iout2	1.0	Output Current #2
4.	Iout3	2.0	Output Current #3
5.	VinMax	60.0	Maximum input voltage
6.	VinMin	50.0	Minimum input voltage
7.	Vout	5.0	Output Voltage
8.	Vout1	5.0	Output Voltage #1
9.	Vout2	3.3	Output Voltage #2
10.	Vout3	24.0	Output Voltage #3
11.	base_pn	UCC28C41	Texas Instruments Base Part Number
12.	source	DC	Input Source Type
13.	ta	30.0	Ambient temperature

Design Assistance

1. UCC28C41 Product Folder : <http://www.ti.com/product/UCC28C41> : contains the data sheet and other resources.

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