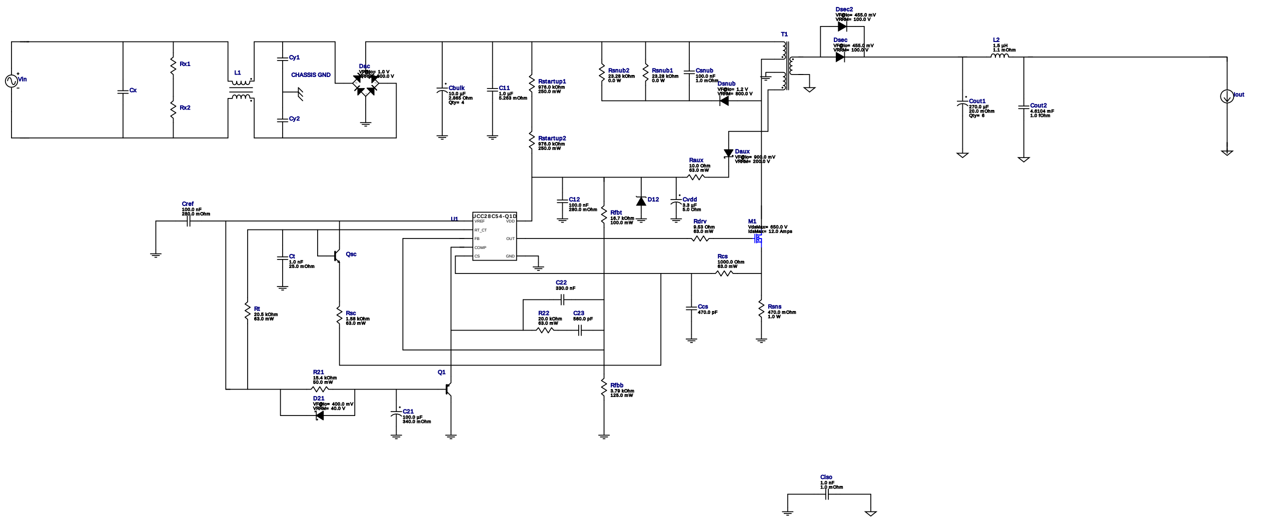
VinMin = 240.0V	Device = UCC28C54QDRQ1
VinMax = 265.0V	Topology = Flyback
Vout = 12.0V	Created = 2023-12-17 19:11:09.877
Iout = 7.0A	BOM Cost = NA
	BOM Count = 49
	Total Pd = 8.06W

WEBENCH ® Design Report

Design : 3 UCC28C54QDRQ1
UCC28C54QDRQ1 240V-265V to 12.00V @ 7A



1. The EMI filter shown in the schematic is a placeholder. It has not yet been designed for the application.This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

Design Alerts

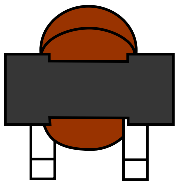
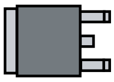
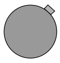
Component Selection Information

The UCC28C54-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application. Click on the transformer symbol in the schematic and select "Explore Transformer Core/Bobbin Selection" to design using specific transformer cores and bobbin.

Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
C11	TDK	C5750X6S2W105K Series= X6S	Cap= 1.0 uF ESR= 5.263 mOhm VDC= 400.0 V IRMS= 0.0 A	1	$1.25	2220 54 mm²
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
C21	Chemi-Con	EMZA350ADA101MF80G Series= MZA	Cap= 100.0 uF ESR= 340.0 mOhm VDC= 35.0 V IRMS= 280.0 mA	1	$0.22	CAPSMT_62_F80 74 mm²
C22	Panasonic	ECPU1C334MA5 Series= ECPU(A)	Cap= 330.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.23	1206 11 mm²
C23	MuRata	GRM1555C1H561JA01J Series= C0G/NP0	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
Cbulk	Panasonic	EEUED2G100 Series= ED	Cap= 10.0 uF ESR= 2.8648 Ohm VDC= 400.0 V IRMS= 300.0 mA	4	$0.31	CAPPR5-10X20 144 mm²

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Ccs	Samsung Electro-Mechanics	CL21C471JBANNNC Series= C0G/NP0	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
Ciso	Johanson Technology	202R18W102KV4E Series= X7R	Cap= 1.0 nF ESR= 1.0 mOhm VDC= 2.0 kV IRMS= 0.0 A	1	$0.06	1206_190 11 mm^2
Cout1	Panasonic	EEHZA1V271P Series= ZA	Cap= 270.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 2.5 A	6	$1.02	SM_RADIAL_10BMM 160 mm^2
Cout2	CUSTOM	CUSTOM Series= ?	Cap= 4.6104 mF ESR= 1.0 fOhm VDC= 30.0 V IRMS= 6.3753 A	1	NA	CUSTOM 0 mm^2
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
Csnub	TDK	C2012X7T2E104K125AA Series= X7T	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 250.0 V IRMS= 0.0 A	1	$0.09	0805 7 mm^2
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
Cvdd	Nichicon	UUD1H3R3MCL1GS Series= uD	Cap= 3.3 uF ESR= 5.0 Ohm VDC= 50.0 V IRMS= 30.0 mA	1	$0.13	SM_RADIAL_4MM 44 mm^2
D12	Diodes Inc.	MMSZ5248B-7-F	Zener	1	$0.04	SOD-123 13 mm^2
D21	Diodes Inc.	ZLLS400TA	VF@Io= 400.0 mV VRRM= 40.0 V	1	$0.16	SOD-323 9 mm^2
Dac	Diodes Inc.	HD06-T	VF@Io= 1.0 V VRRM= 600.0 V	1	$0.15	MiniDIP 62 mm^2
Daux	Fairchild Semiconductor	S320	VF@Io= 900.0 mV VRRM= 200.0 V	1	$0.33	SMB 44 mm^2
Dsec	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.94	DDPAK 210 mm^2
Dsec2	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.94	DDPAK 210 mm^2
Dsnub	Microsemi	UFS180JE3/TR13	VF@Io= 1.2 V VRRM= 800.0 V	1	$0.95	DO-214BA 42 mm^2

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
L2	Coilcraft	SER1590-152MLB	L= 1.5 µH 1.1 mOhm	1	$1.12	 SER1590 324 mm²
M1	STMicroelectronics	STD16N65M5	VdsMax= 650.0 V IdsMax= 12.0 Amps	1	$1.91	 DPAK 102 mm²
Q1	Diodes Inc.	MMBT3906-7-F	Bipolar Transistor	1	$0.02	 SOT-23 14 mm²
Qsc	STMicroelectronics	2N2222A	Bipolar Transistor	1	$1.19	 TO-18 57 mm²
R21	Yageo	RC0201FR-0715K4L Series= ?	Res= 15.4 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm²
R22	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Raux	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rcs	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rdrv	Vishay-Dale	CRCW04029R53FKED Series= CRCW..e3	Res= 9.53 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rfbb	Yageo	RT0805BRD073K79L Series= ?	Res= 3.79 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	0805 7 mm²
Rfbt	Yageo	RT0603BRD0716K7L Series= ?	Res= 16.7 kOhm Power= 100.0 mW Tolerance= 0.1%	1	$0.04	0603 5 mm²
Rsc	Vishay-Dale	CRCW04021K58FKED Series= CRCW..e3	Res= 1.58 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rsns	Stackpole Electronics Inc	RSF1FTR470 Series= ?	Res= 470.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.05	 RSF1 150 mm²
Rsnub1	CUSTOM	CUSTOM Series= ?	Res= 23.28 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm²
Rsnub2	CUSTOM	CUSTOM Series= ?	Res= 23.28 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm²
Rstartup1	Yageo	RC1206FR-07976KL Series= ?	Res= 976.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm²
Rstartup2	Yageo	RC1206FR-07976KL Series= ?	Res= 976.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm²
Rt	Vishay-Dale	CRCW040220K5FKED Series= CRCW..e3	Res= 20.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

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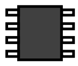
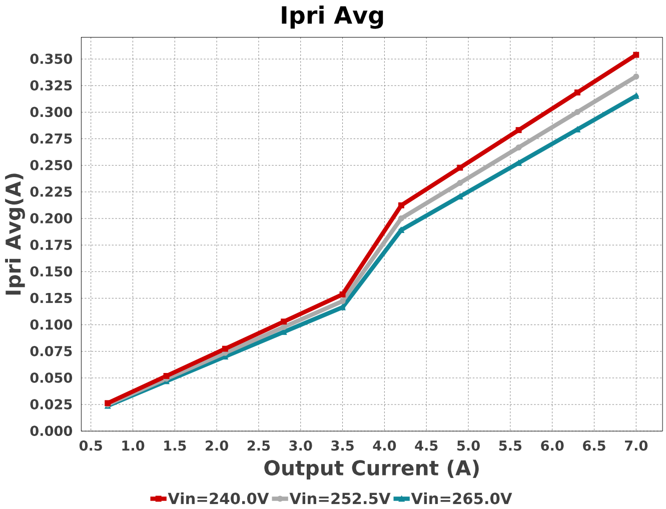
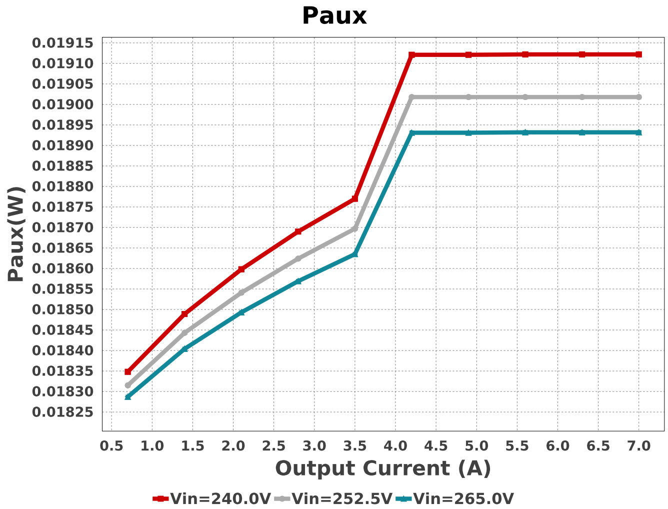
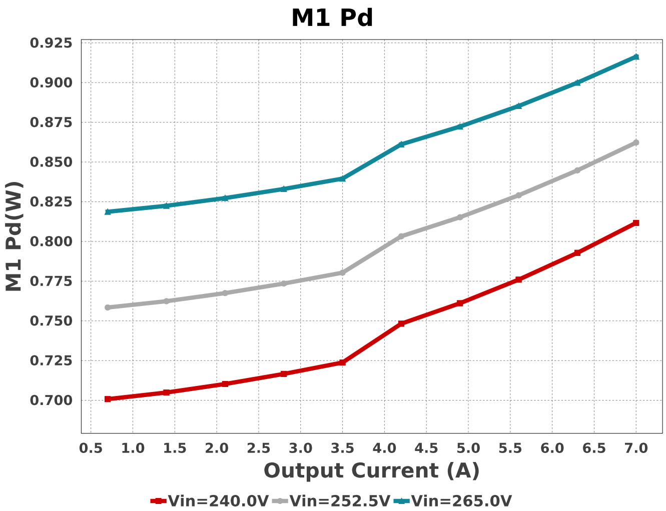
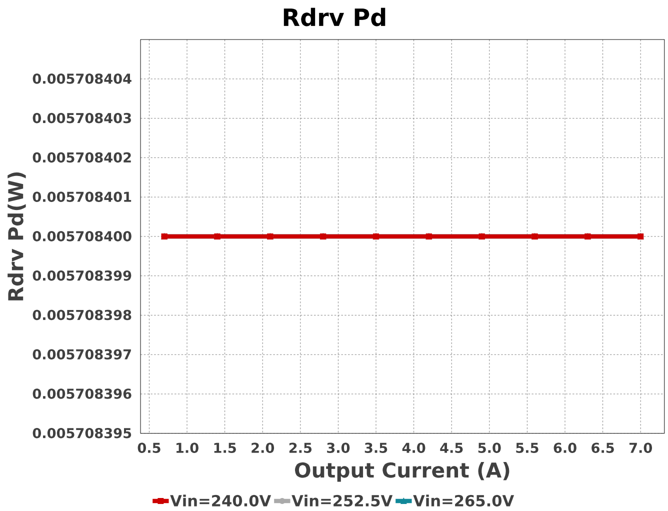
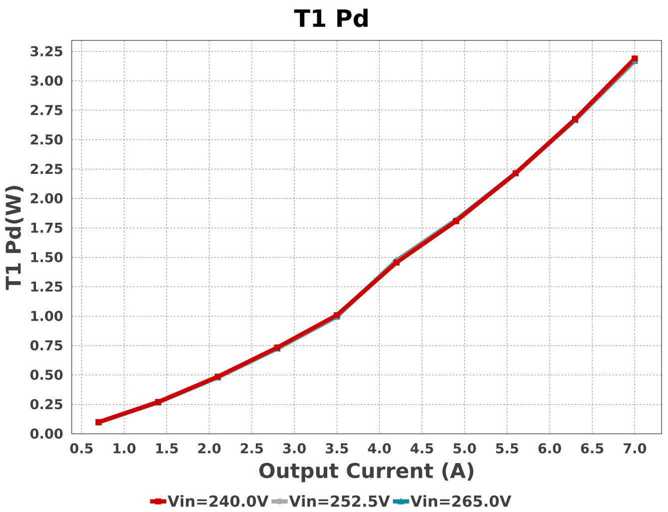
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
T1	Core=Wurth Elektronik , CoilFormer=Wurth Elektronik	Core=150-2171 , CoilFormer=070-5783	Lp= 1.846 mH Turns Ratio(Nas)= 17:14 Turns Ratio(Nps)= 146:14 Npri= 146.0 Naux= 17.0 Nsec= 14.0	1	NA	ERL35 1771 mm^2
U1	Texas Instruments	UCC28C54QDRQ1	Switcher	1	$0.67	 D0008A 57 mm^2

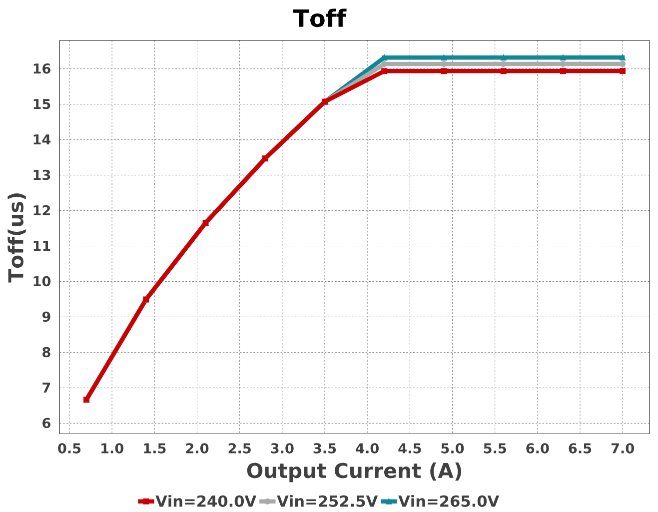


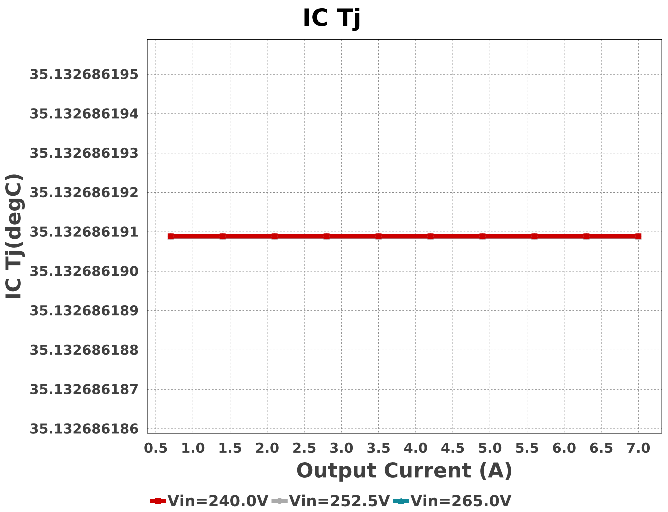


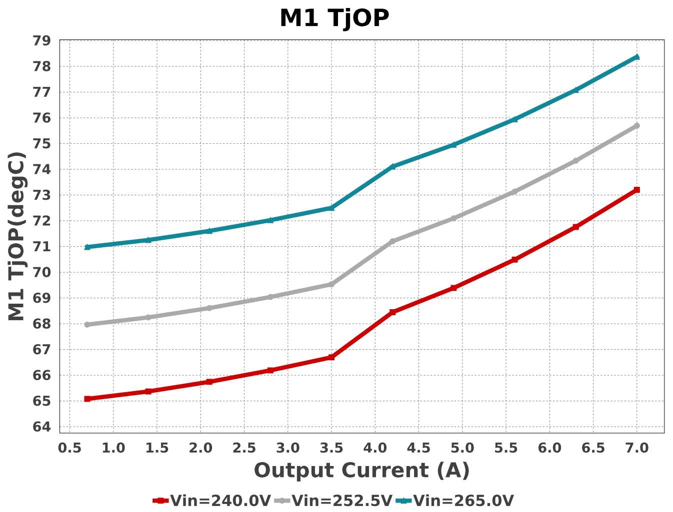


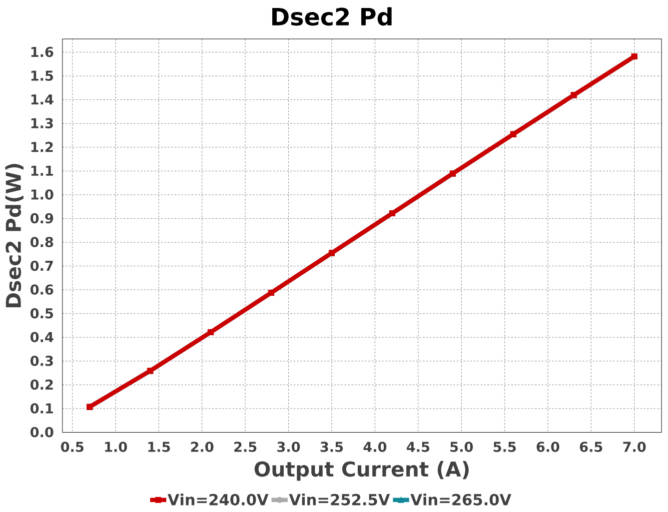


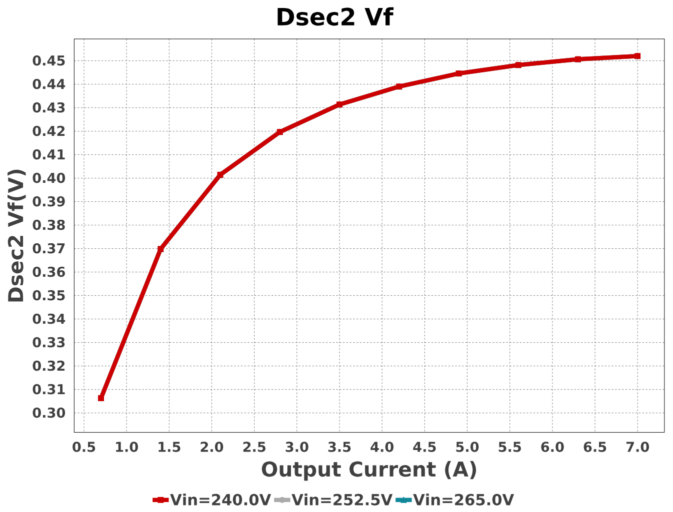












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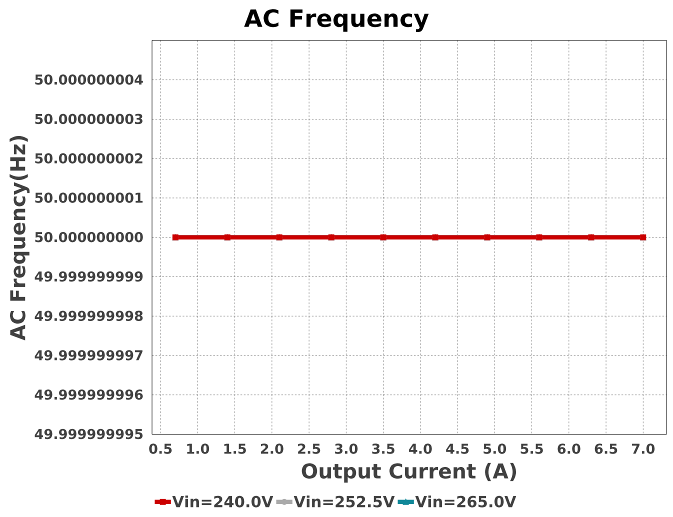
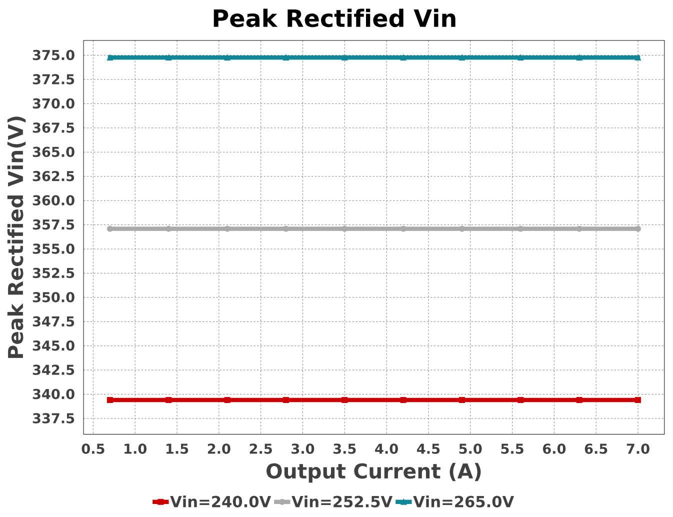
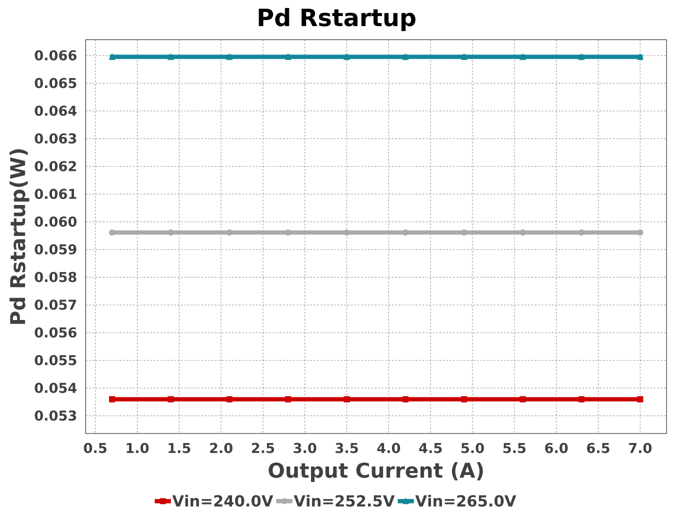
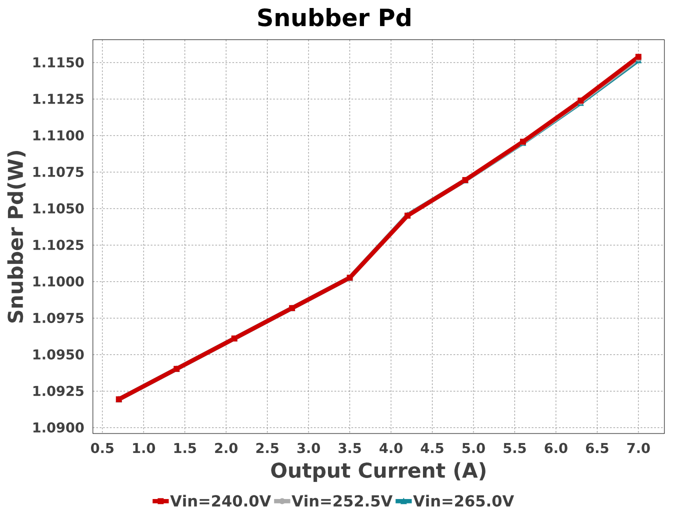
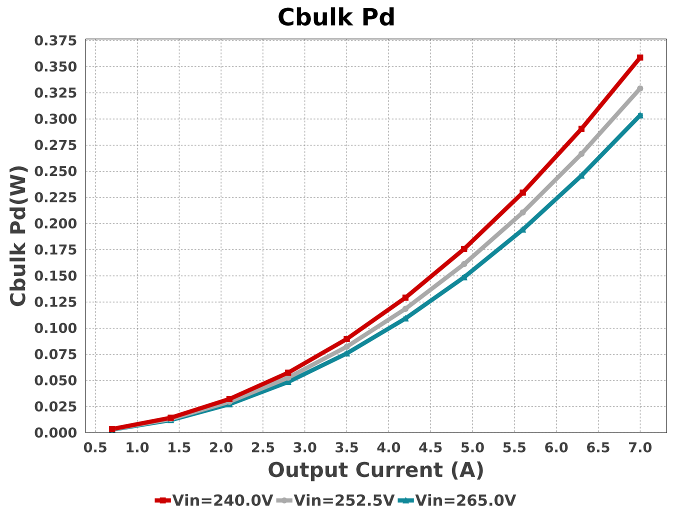
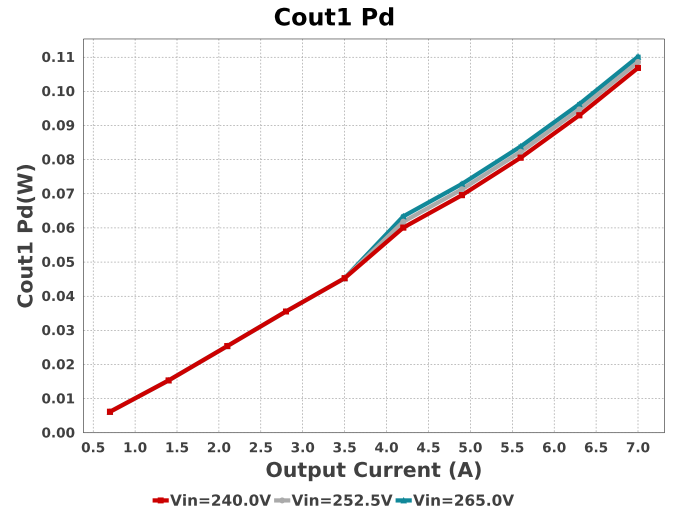

AC Frequency
AC Frequency(Hz)
50.000000004
50.000000003
50.000000002
50.000000001
50.000000000
49.999999999
49.999999998
49.999999997
49.999999996
49.999999995
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

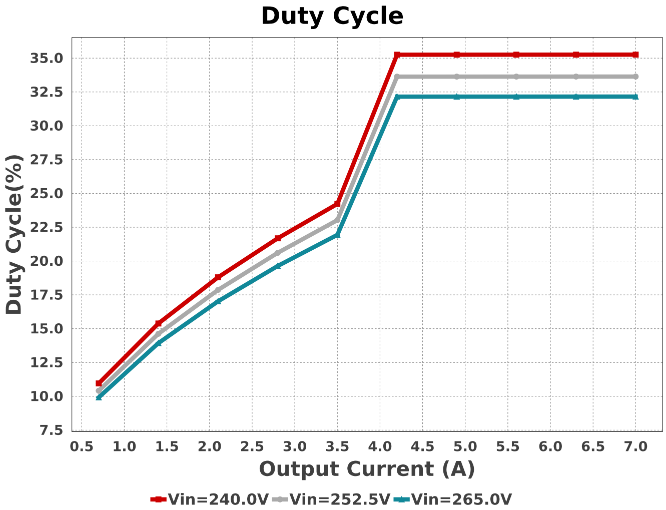

Peak Rectified Vin
Peak Rectified Vin(V)
375.0
372.5
370.0
367.5
365.0
362.5
360.0
357.5
355.0
352.5
350.0
347.5
345.0
342.5
340.0
337.5
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

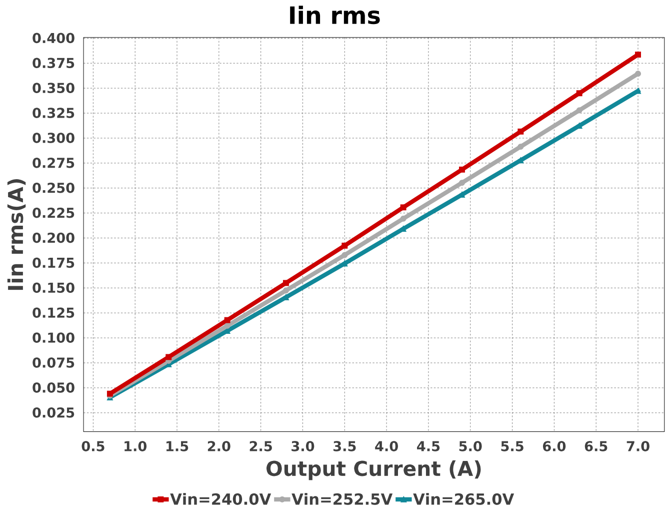

Pd Rstartup
Pd Rstartup(W)
0.066
0.065
0.064
0.063
0.062
0.061
0.060
0.059
0.058
0.057
0.056
0.055
0.054
0.053
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

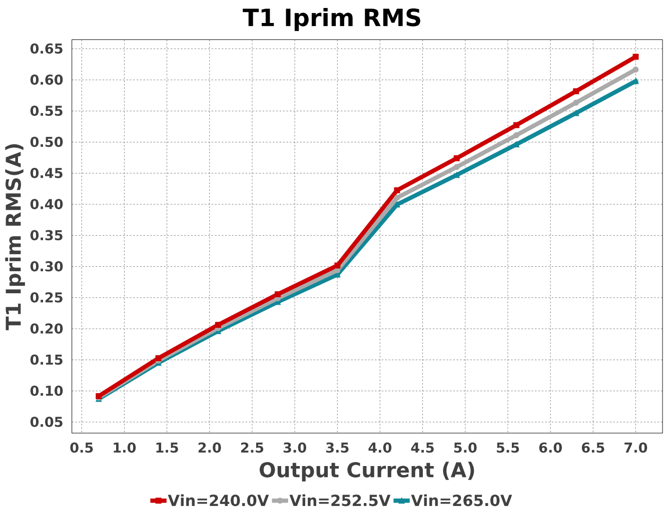

Snubber Pd
Snubber Pd(W)
1.1150
1.1125
1.1100
1.1075
1.1050
1.1025
1.1000
1.0975
1.0950
1.0925
1.0900
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

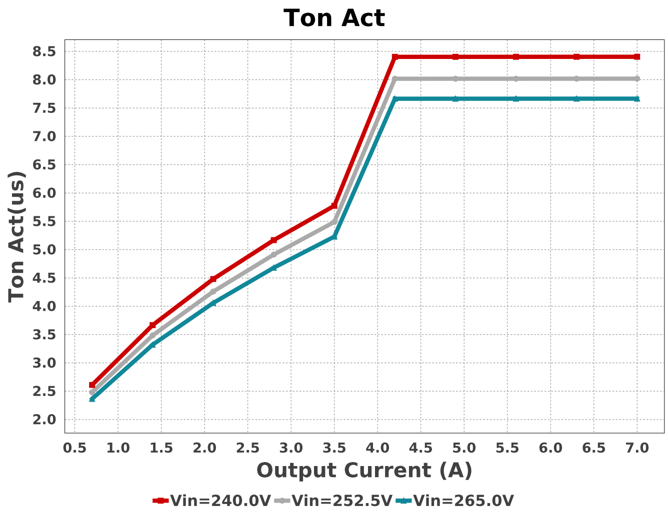

Cbulk Pd
Cbulk Pd(W)
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

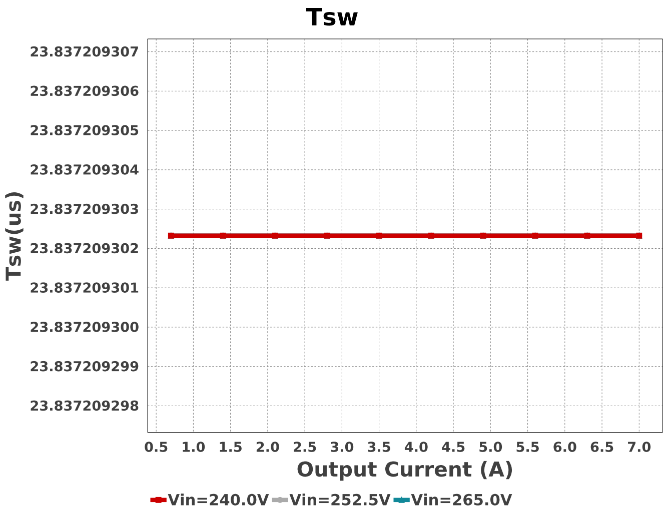

Cout1 Pd
Cout1 Pd(W)
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

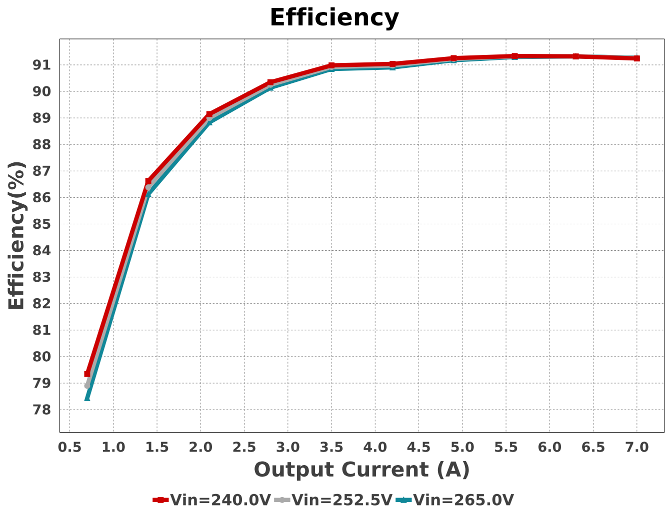

Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

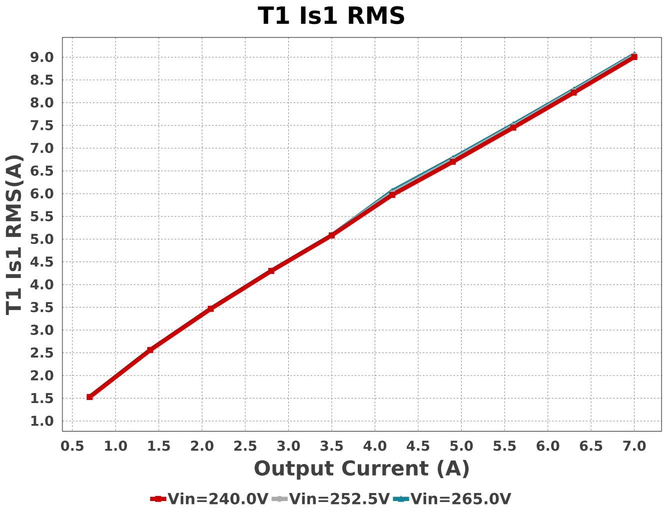

Iin rms
Iin rms(A)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

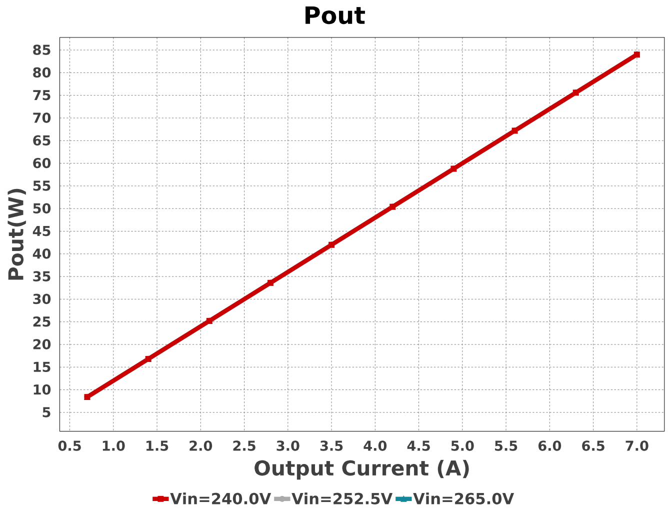

T1 Iprim RMS
T1 Iprim RMS(A)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

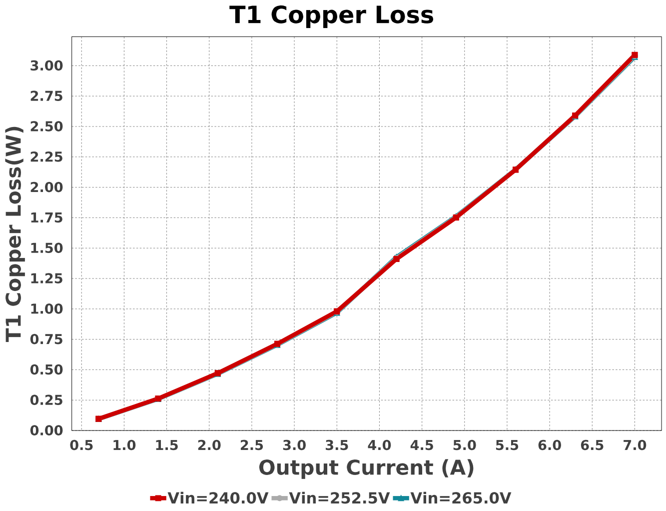

Ton Act
Ton Act(us)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

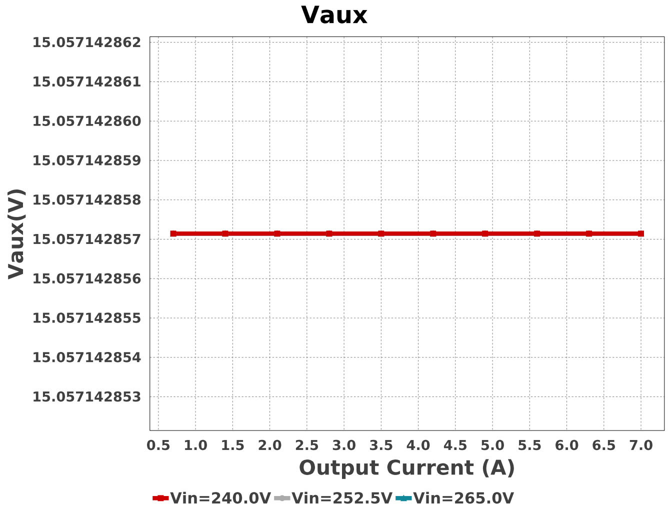

Tsw
Tsw(us)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

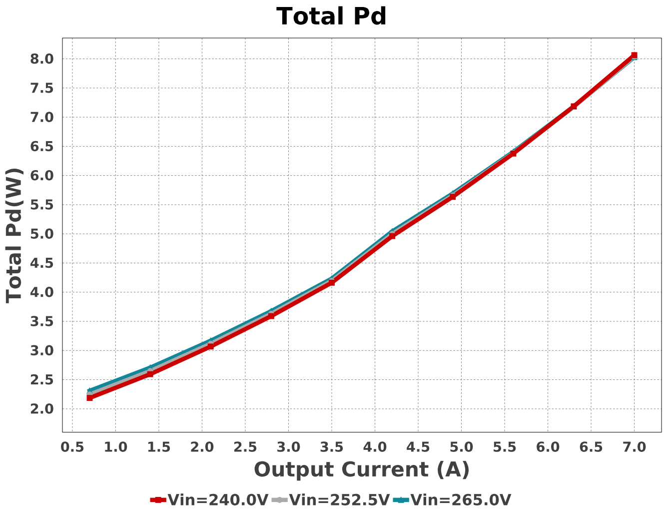

Efficiency
Efficiency(%)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

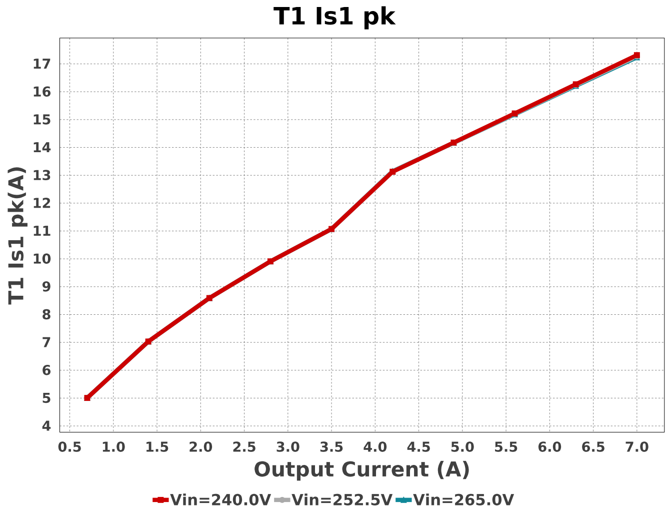

T1 Is1 RMS
T1 Is1 RMS(A)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V


Pout
Pout(W)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

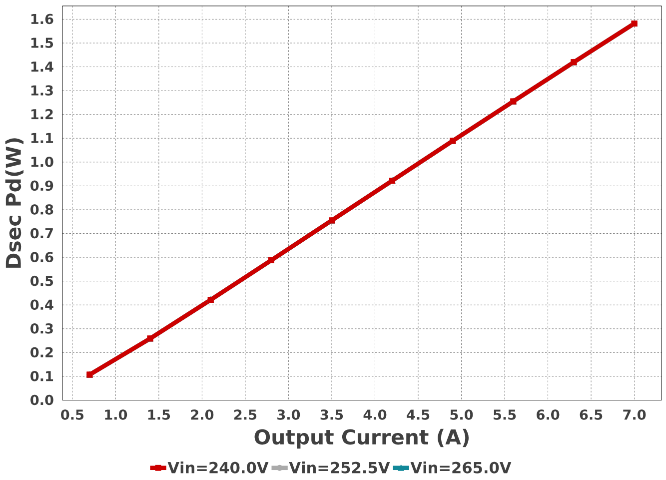

T1 Copper Loss
T1 Copper Loss(W)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V


Vaux
Vaux(V)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

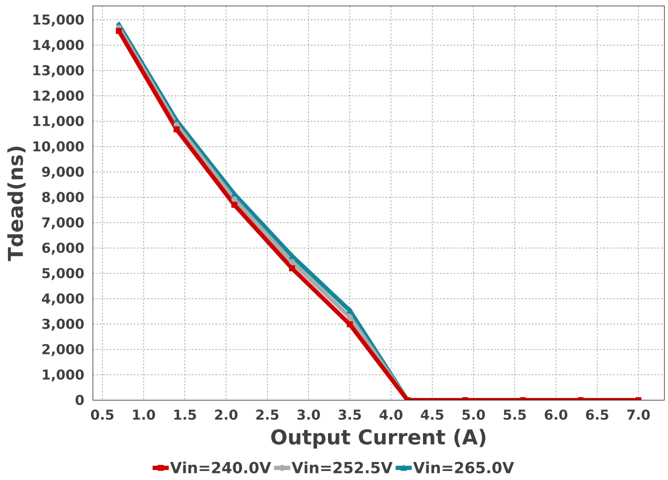

Total Pd
Total Pd(W)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V


T1 Is1 pk
T1 Is1 pk(A)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

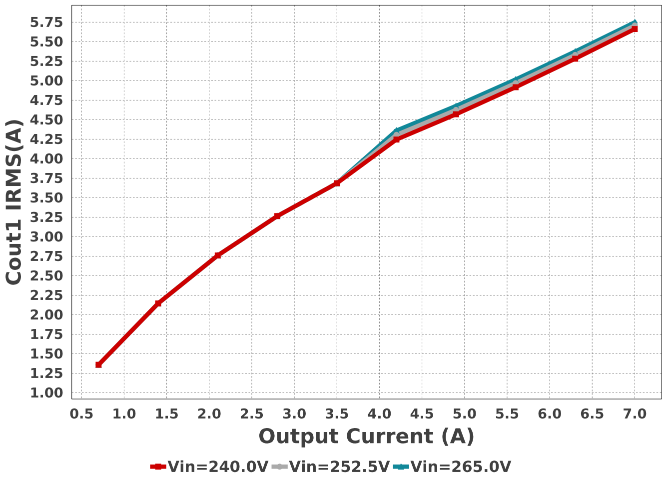
Dsec Pd



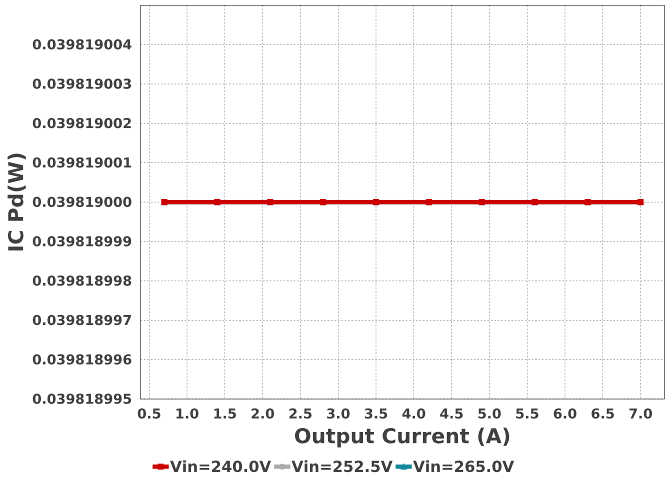
Tdead



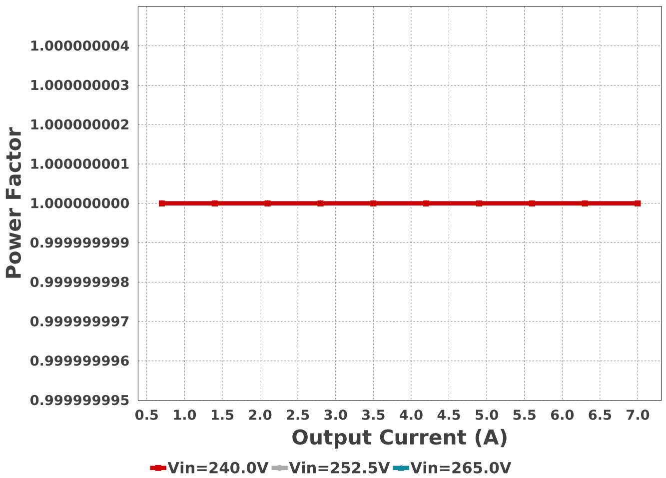
Cout1 IRMS



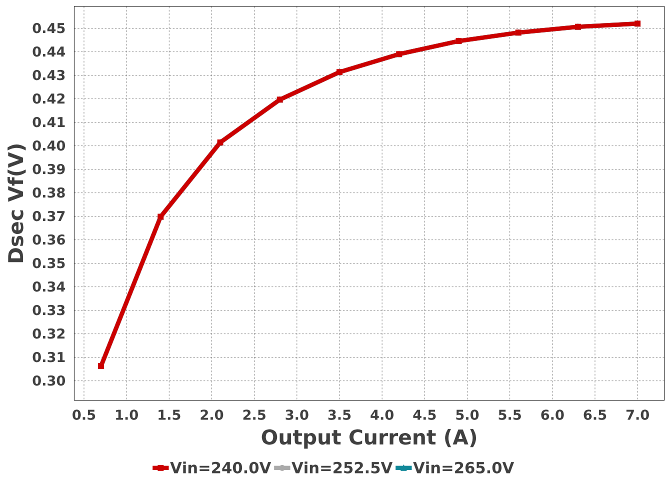
IC Pd

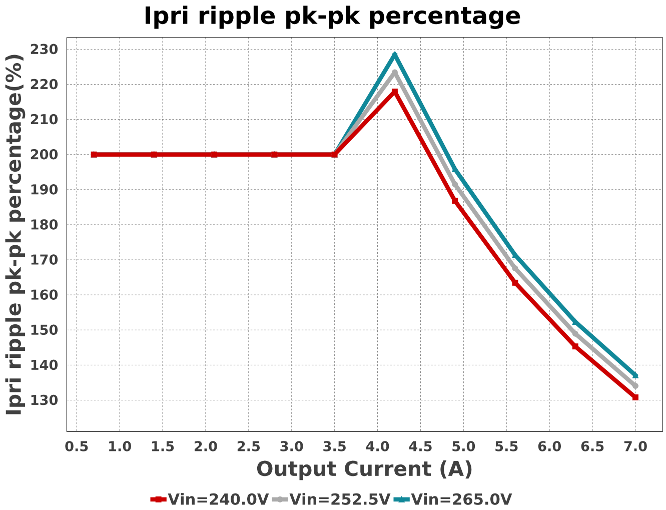


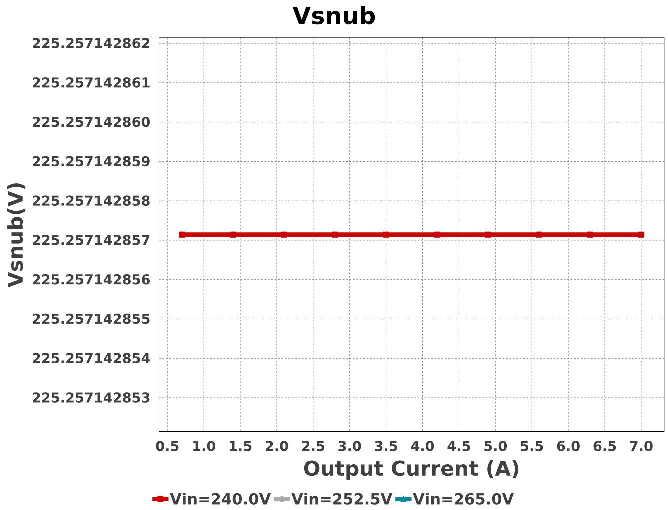
Power Factor

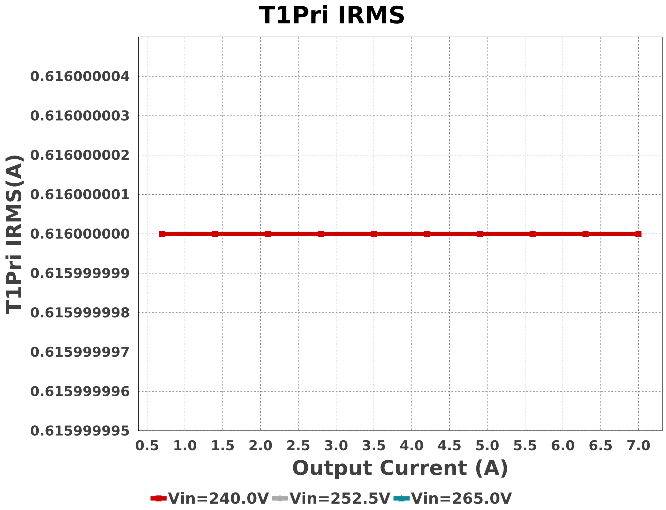


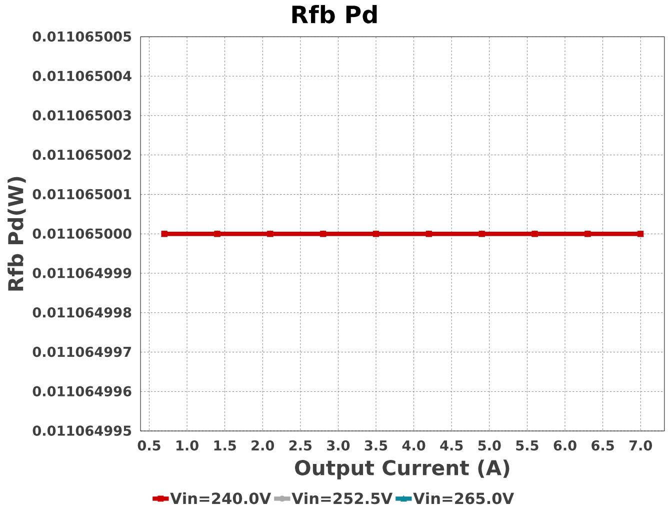
Dsec Vf

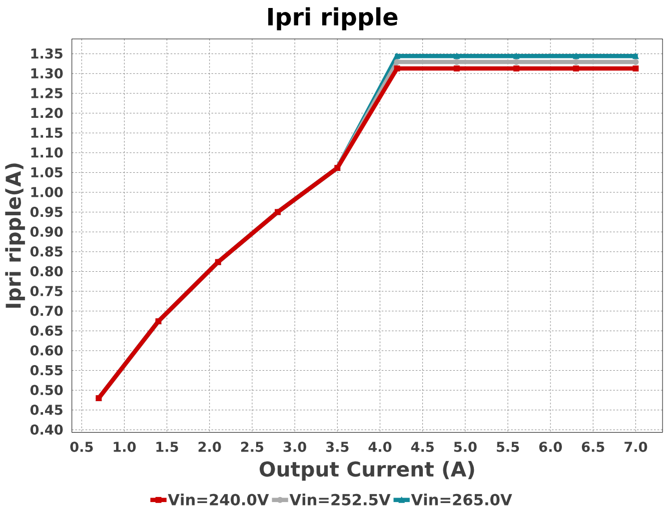


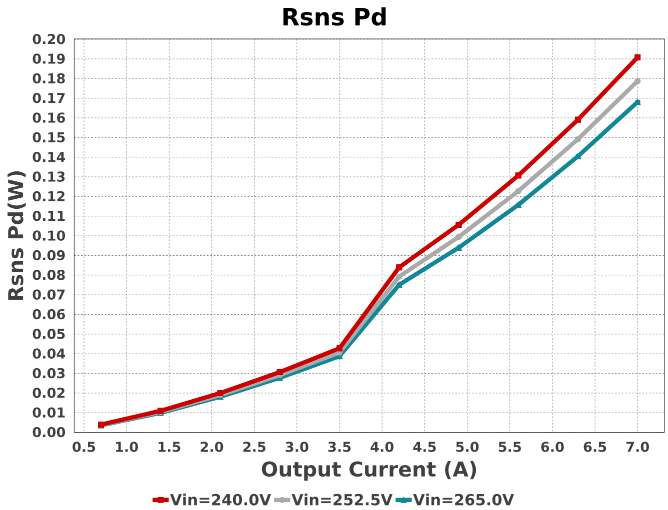

Ipri ripple pk-pk percentage
Ipri ripple pk-pk percentage(%)
230 220 210 200 190 180 170 160 150 140 130
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

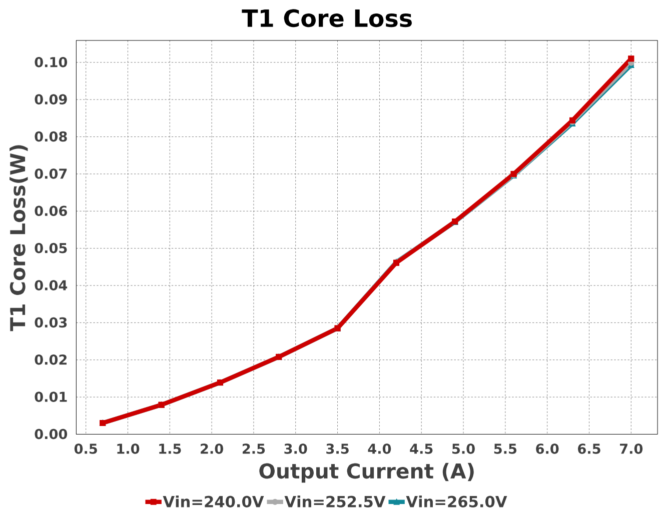

Vsnub
Vsnub(V)
225.257142862 225.257142861 225.257142860 225.257142859 225.257142858 225.257142857 225.257142856 225.257142855 225.257142854 225.257142853
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

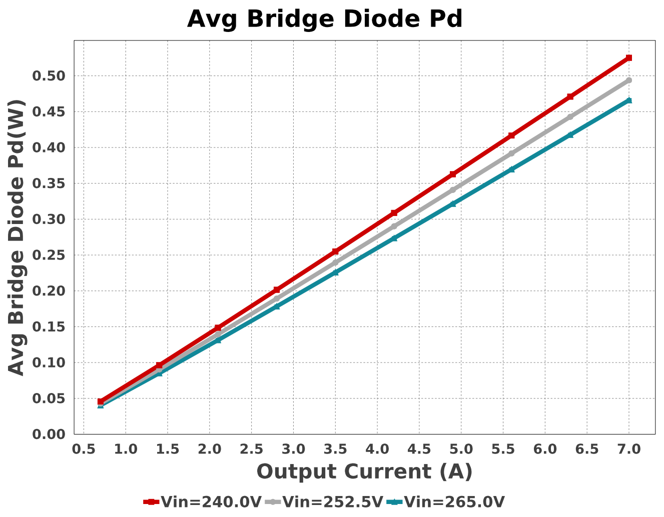

T1Pri IRMS
T1Pri IRMS(A)
0.616000004 0.616000003 0.616000002 0.616000001 0.616000000 0.615999999 0.615999998 0.615999997 0.615999996 0.615999995
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

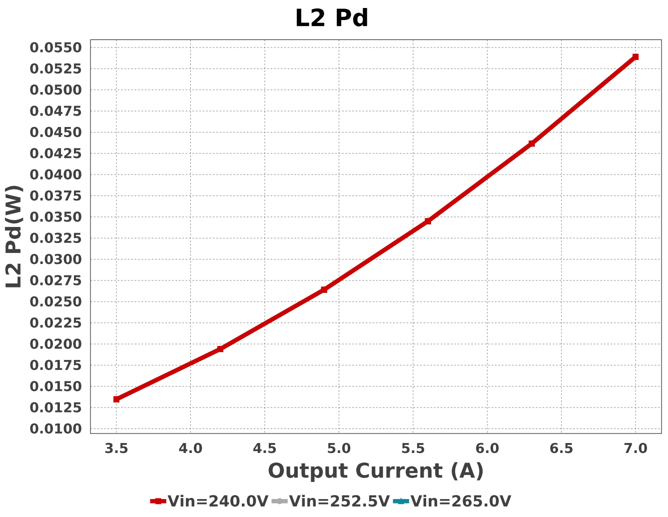

Rfb Pd
Rfb Pd(W)
0.011065005 0.011065004 0.011065003 0.011065002 0.011065001 0.011065000 0.011064999 0.011064998 0.011064997 0.011064996 0.011064995
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

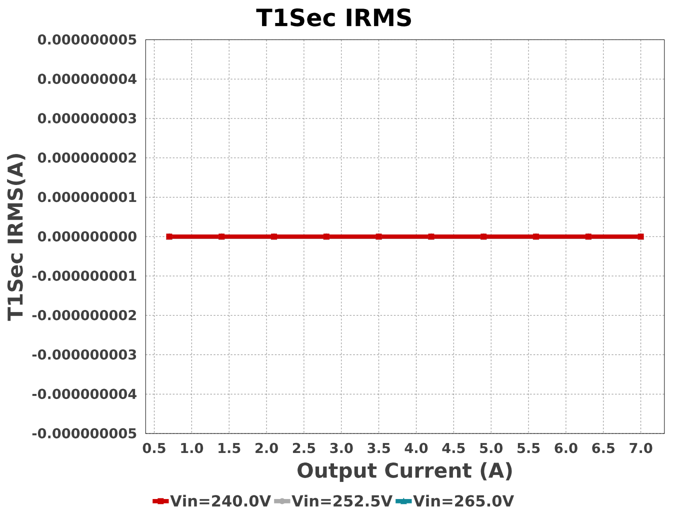

Ipri ripple
Ipri ripple(A)
1.35 1.30 1.25 1.20 1.15 1.10 1.05 1.00 0.95 0.90 0.85 0.80 0.75 0.70 0.65 0.60 0.55 0.50 0.45 0.40
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

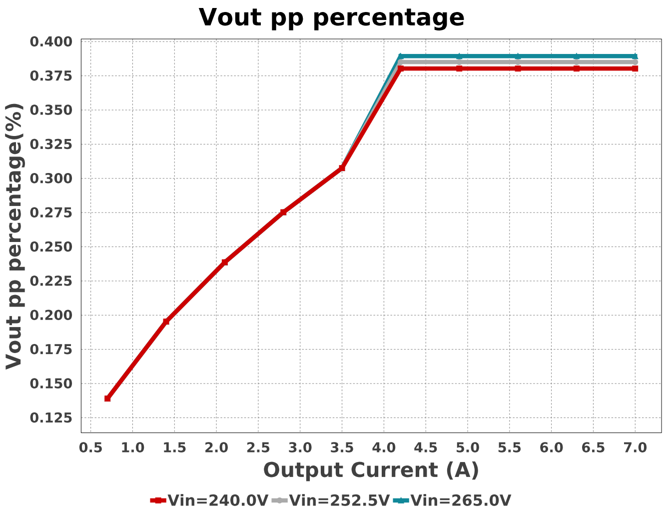

Rsns Pd
Rsns Pd(W)
0.20 0.19 0.18 0.17 0.16 0.15 0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02 0.01 0.00
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

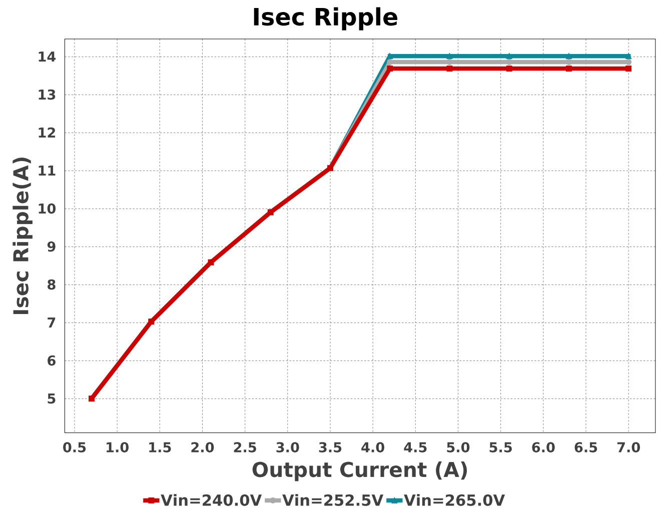

T1 Core Loss
T1 Core Loss(W)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

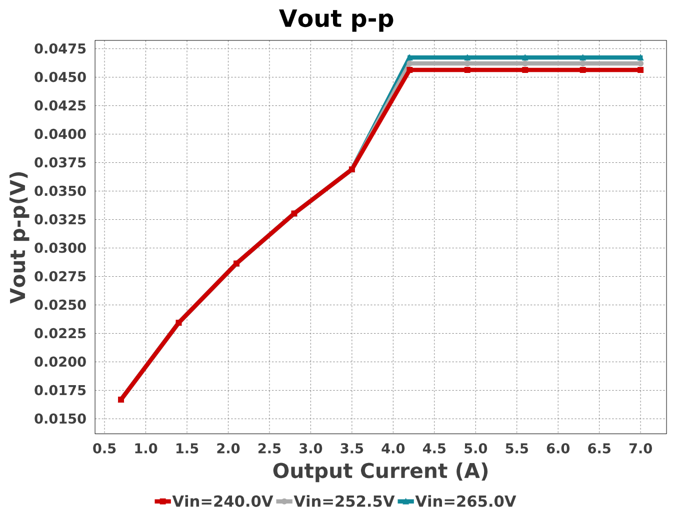

Avg Bridge Diode Pd
Avg Bridge Diode Pd(W)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V

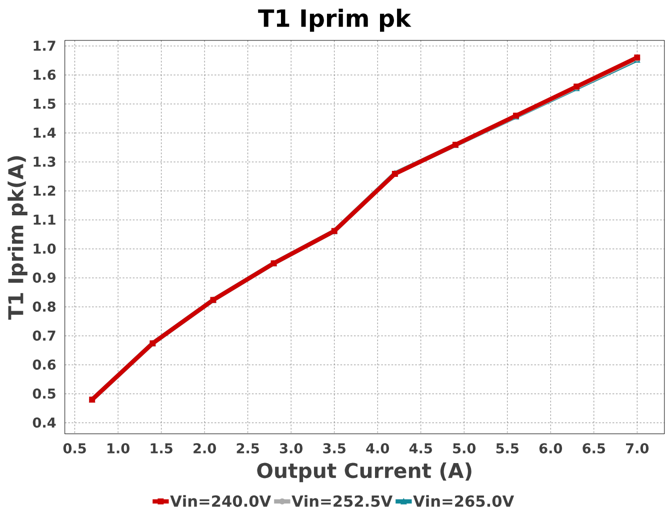

L2 Pd
L2 Pd(W)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V


T1Sec IRMS
T1Sec IRMS(A)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V


Vout pp percentage
Vout pp percentage(%)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V


Isec Ripple
Isec Ripple(A)
Output Current (A)
Vin=240.0V Vin=252.5V Vin=265.0V





Operating Values

#	Name	Value	Category	Description
1.	Cbulk Pd	358.74 mW	Capacitor	Bulk capacitor power dissipation
2.	Cout1 IRMS	5.662 A	Capacitor	Output capacitor1 RMS ripple current
3.	Cout1 Pd	107.35 mW	Capacitor	Output capacitor1 power dissipation
4.	Avg Bridge Diode Pd	525.09 mW	Diode	Average Power Dissipation in the Bridge Diode over the AC Line Period
5.	Daux trr	30.0 ns	Diode	Auxiliary Diode Reverse Recovery Time
6.	Dsec Pd	1.582 W	Diode	Secondary Diode Power Dissipation
7.	Dsec Vf	452.004 mV	Diode	Effective Forward Voltage Drop at the Operating Current
8.	Dsec trr	0.0 ns	Diode	Output Diode Reverse Recovery Time
9.	Dsec2 Pd	1.582 W	Diode	Secondary Diode Power Dissipation
10.	Dsec2 Vf	452.004 mV	Diode	Effective Forward Voltage Drop at the Operating Current
11.	Dsnub trr	60.0 ns	Diode	Snubber Diode Reverse Recovery Time
12.	IC Pd	39.819 mW	IC	IC power dissipation
13.	IC Tj	35.133 degC	IC	IC junction temperature
14.	ICThetaJA	128.9 degC/W	IC	IC junction-to-ambient thermal resistance
15.	L2 Pd	53.9 mW	Inductor	Average Power Dissipation in the Inductor Over the AC Line Period
16.	M1 Pd	814.06 mW	Mosfet	M1 MOSFET total power dissipation
17.	M1 TjOP	73.203 degC	Mosfet	M1 MOSFET junction temperature
18.	Avg Bridge Diode Pd	525.09 mW	Power	Average Power Dissipation in the Bridge Diode over the AC Line Period
19.	Cbulk Pd	358.74 mW	Power	Bulk capacitor power dissipation
20.	Cout1 Pd	106.87 mW	Power	Output capacitor1 power dissipation
21.	Dsec Pd	1.582 W	Power	Secondary Diode Power Dissipation
22.	Dsec2 Pd	1.582 W	Power	Secondary Diode Power Dissipation
23.	IC Pd	39.819 mW	Power	IC power dissipation
24.	L2 Pd	53.9 mW	Power	Average Power Dissipation in the Inductor Over the AC Line Period
25.	M1 Pd	811.65 mW	Power	M1 MOSFET total power dissipation
26.	Paux	19.122 mW	Power	Power Dissipation in Raux and Daux
27.	Pd Rstartup	53.597 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
28.	Rdrv Pd	5.708 mW	Power	Power Dissipation in Gate Drive Resistor
29.	Rfb Pd	11.065 mW	Power	Rfb Power Dissipation
30.	Rsns Pd	190.81 mW	Power	Current Limit Sense Resistor Power Dissipation
31.	Snubber Pd	1.115 W	Power	Snubber Power Dissipation
32.	T1 Copper Loss	3.089 W	Power	Transformer Copper Loss Power Dissipation
33.	T1 Core Loss	101.0 mW	Power	Transformer Core Loss Power Dissipation
34.	T1 Pd	3.19 W	Power	Estimated Losses in Transformer
35.	Total Pd	8.063 W	Power	Total Power Dissipation
36.	Pd Rstartup	53.597 mW	Resistor	Power Dissipation in Rstartup1 and Rstartup2
37.	Rdrv Pd	5.708 mW	Resistor	Power Dissipation in Gate Drive Resistor
38.	Rfb Pd	11.065 mW	Resistor	Rfb Power Dissipation
39.	Rsns Pd	191.95 mW	Resistor	Current Limit Sense Resistor Power Dissipation
40.	AC Frequency	50.0 Hz	System Information	Input AC frequency
41.	BOM Count	49	System Information	Total Design BOM count
42.	Duty Cycle	35.261 %	System Information	Duty cycle
43.	Efficiency	91.242 %	System Information	Steady state efficiency
44.	FootPrint	4.994 k mm^2	System Information	Total Foot Print Area of BOM components
45.	Frequency	41.951 kHz	System Information	Switching frequency

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#	Name	Value	Category	Description
46.	Iin rms	383.6 mA	System Information	RMS Input Current
47.	Iout	7.0 A	System Information	Iout operating point
48.	Mode	CCM	System Information	Conduction Mode
49.	Peak Rectified Vin	339.408 V	System Information	Peak voltage seen at rectified input
50.	Pout	84.0 W	System Information	Total output power
51.	Power Factor	1.0	System Information	Assumed Power Factor for the Application
52.	Tdead	0.0 ns	System Information	Approximate Dead Time of the Regulator
53.	Toff	15.939 us	System Information	Approximate Converter Off Time
54.	Ton Act	8.405 us	System Information	Approximate Converter On Time
55.	Total BOM	NA	System Information	Total BOM Cost
56.	Tsw	23.837 us	System Information	Switching Time Period
57.	Vin_RMS	240.0 V	System Information	Vin operating point
58.	Vout	12.0 V	System Information	Operational Output Voltage
59.	Vout p-p	45.637 mV	System Information	Peak-to-peak output ripple voltage
60.	Vout pp percentage	380.305 m%	System Information	Output Voltage ripple percentage
61.	Vsnub	225.257 V	System Information	Voltage Across the Snubber
62.	Ipri Avg	353.965 mA	Transformer	Average Current in Primary Winding over the complete Switching Period
63.	Ipri ripple	1.313 A	Transformer	Ripple Current in the Primary Winding
64.	Ipri ripple pk-pk percentage	130.781 %	Transformer	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
65.	Isec Ripple	13.691 A	Transformer	Ripple Current in the Secondary Winding
66.	Paux	19.128 mW	Transformer	Power Dissipation in Raux and Daux
67.	T1 Copper Loss	2.711 W	Transformer	Transformer Copper Loss Power Dissipation
68.	T1 Core Loss	94.3 mW	Transformer	Transformer Core Loss Power Dissipation
69.	T1 Iprim RMS	637.156 mA	Transformer	Transformer Primary RMS Current
70.	T1 Iprim pk	1.66 A	Transformer	Transformer Primary Peak Current
71.	T1 Is1 RMS	9.003 A	Transformer	Transformer Secondary1 RMS Current
72.	T1 Is1 pk	17.314 A	Transformer	Transformer Secondary1 Peak Current
73.	T1 Pd	2.806 W	Transformer	Estimated Losses in Transformer
74.	T1Pri IRMS	616.0 mA	Transformer	Transformer Primary RMS Current
75.	T1Sec IRMS	0.0 A	Transformer	Transformer Secondary RMS Current
76.	Vaux	15.057 V	Transformer	Auxiliary Voltage

Design Inputs

Name	Value	Description
Iout	7.0	Maximum Output Current
VinMax	265.0	Maximum input voltage
VinMin	240.0	Minimum input voltage
Vout	12.0	Output Voltage
acFrequency	50.0	AC Frequency
base_pn	UCC28C54-Q1	Base Product Number
source	AC	Input Source Type
Ta	30.0	Ambient temperature

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of Cin and Cout, and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

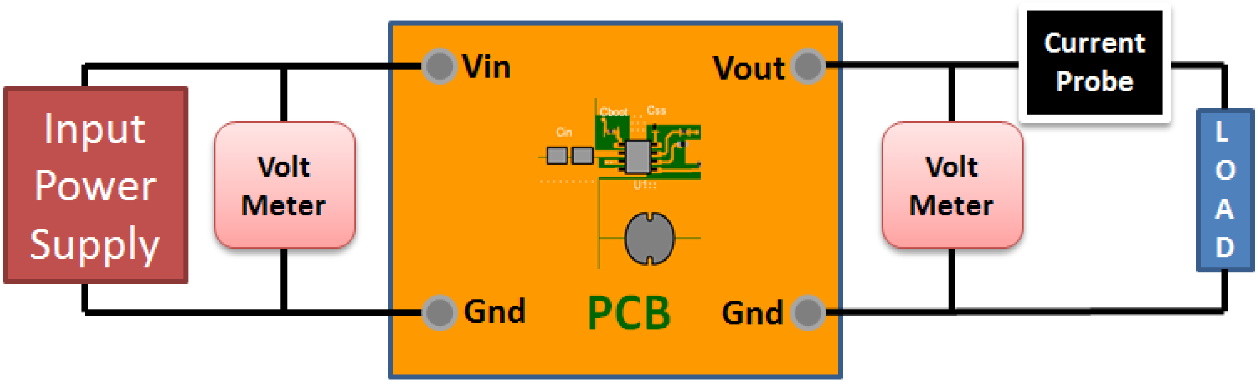
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 240.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum Iout of the design from Vout and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



WEBENCH® Transformer Report

#	Name	Value
1.	Core Part Number	150-2171
2.	Core Manufacturer	Wurth Elektronik
3.	Coil Former Part Number	070-5783
4.	Coil Former Manufacturer	Wurth Elektronik

Transformer Electrical Diagram

Primary

Turns	146.0
AWG	23.0
Layers	4.0
Strands	1.0
Insulation Type	Heavy Insulated Magnet Wire

Secondary

Turns	14.0
AWG	23.0
Layers	1.0
Strands	2.0
Insulation Type	Triple Insulated

Auxiliary

Turns	17.0
AWG	28.0
Layers	1.0
Strands	4.0
Insulation Type	Heavy Insulated Magnet Wire

Transformer Construction Diagram

Winding Instruction

Winding	AWG	Turns	Winding Orientation
Primary First 2/4.0	23.0	73	Clockwise
Triple Insulated Secondary	23.0	14.0	Counter Clockwise
Auxiliary	28.0	17.0	Counter Clockwise
Primary Second 2/4.0	23.0	73	Clockwise

Transformer Parameters

#	Name	Value
1.	Lpri	0.00185H
2.	Inductance Factor(Al)	87.0nH
3.	Npri	146.0
4.	Nsec	14.0
5.	Naux	17.0
6.	Core Type	ERL35
7.	Core Material	TP4A

#	Name	Value
8.	Bmax	0.20T
9.	Switching Frequency	41.95kHz
10.	DMax	0.36
11.	Ipk(Primary)	1.62A
12.	Irms(Primary)	0.62A
13.	Ipk(Secondary)	16.9A
14.	Irms(Secondary)	8.57A

Design Assistance

1. Feature Highlights: This device provides the features that are necessary to implement off-line or dc-to-dc fixed-frequency current-mode control schemes, with a minimum number of external components.

2. The UCC28C54-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application

3. Master key : 30D5671C57F5F467[v1]

4. **UCC28C54-Q1** Product Folder : http://www.ti.com/product/UCC28C54%2DQ1 : contains the data sheet and other resources.

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