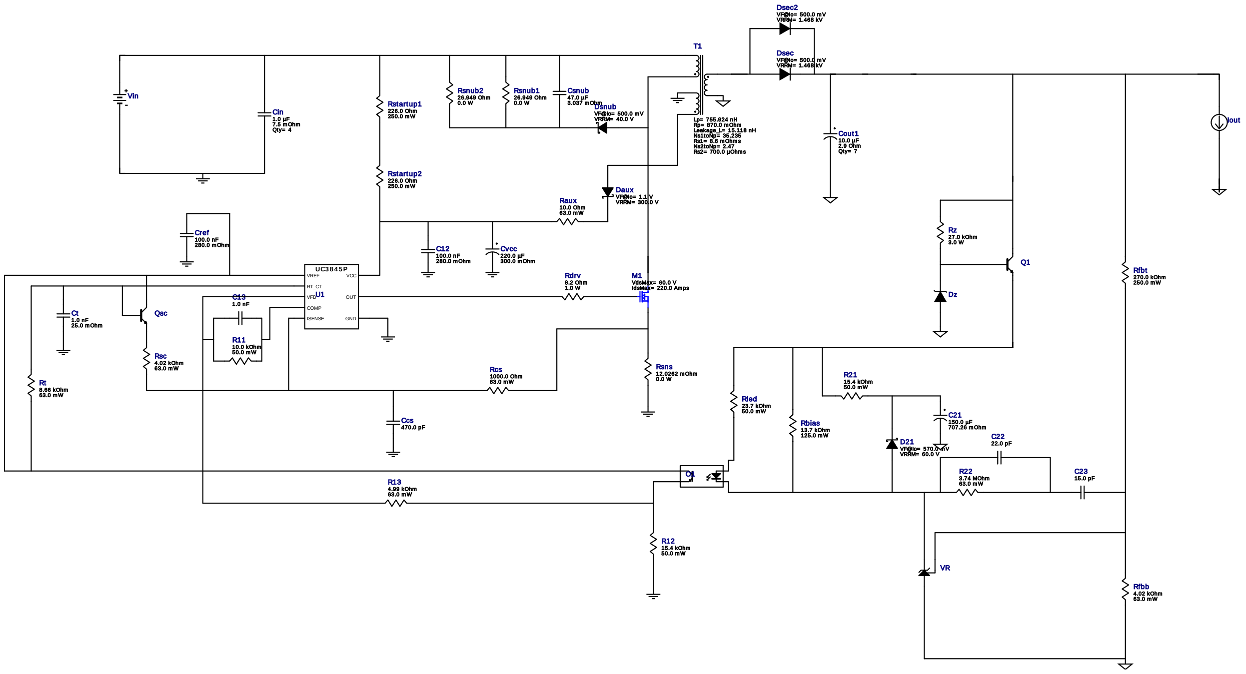
WEBENCH ® Design Report

VinMin = 10.0V
VinMax = 16.0V
Vout = 170.0V
Iout = 0.6A

Device = UC3845N
Topology = Flyback
Created = 2025-09-09 19:42:15.042
BOM Cost = NA
BOM Count = 54
Total Pd = 13.3W

Design : 33 UC3845N
UC3845N 10V-16V to 170.00V @ 0.6A



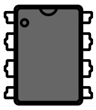
Electrical BOM

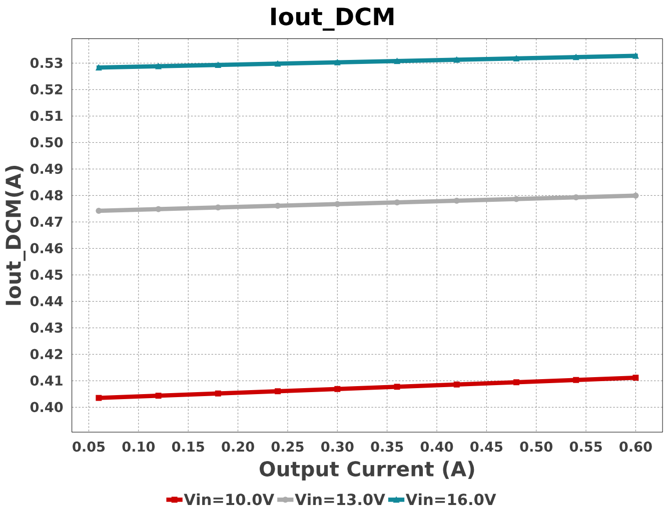
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
C12	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
C13	MuRata	GRM1555C1H102JA01J Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
C21	Chemi-Con	ELXZ630ELL151MH20D Series= LXZ	Cap= 150.0 uF ESR= 707.26 mOhm VDC= 63.0 V IRMS= 690.0 mA	1	$0.21	Chemi-Con_800x2000 100 mm^2
C22	Samsung Electro-Mechanics	CL21C220JBANNNC Series= C0G/NP0	Cap= 22.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
C23	Yageo	CC0805JRNPO9BN150 Series= C0G/NP0	Cap= 15.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
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
Cin	TDK	C3216X7R2A105M160AA Series= X7R	Cap= 1.0 uF ESR= 7.5 mOhm VDC= 100.0 V IRMS= 5.9235 A	4	$0.12	1206 11 mm^2

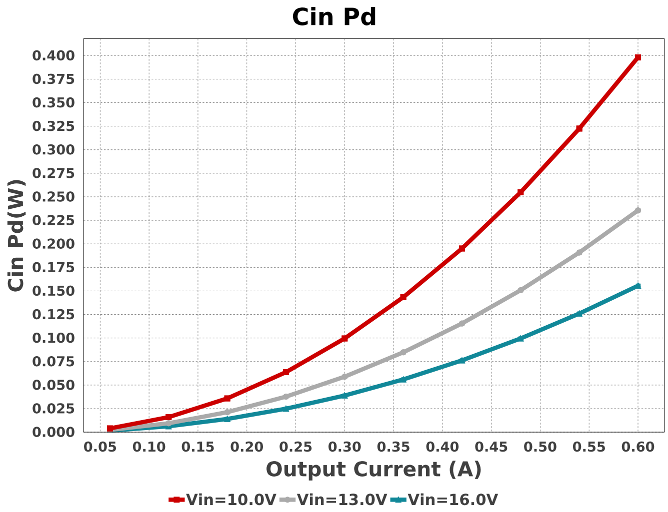
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cout1	Kemet	ESG106M400AH4AA Series= 2334	Cap= 10.0 uF ESR= 2.9 Ohm VDC= 400.0 V IRMS= 100.0 mA	7	$0.29	ESG106 144 mm^2
Cref	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
Csnub	MuRata	GRM32ER61C476KE15L Series= X5R	Cap= 47.0 uF ESR= 3.037 mOhm VDC= 16.0 V IRMS= 4.59346 A	1	$0.17	1210_280 15 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
Cvcc	Chemi-Con	EMVY350ADA221MHA0G Series= MVY	Cap= 220.0 uF ESR= 300.0 mOhm VDC= 35.0 V IRMS= 450.0 mA	1	$0.28	CAPSMT_62_HA0 106 mm^2
D21	Nexperia	PMEG6010CEH,115	VF@Io= 570.0 mV VRRM= 60.0 V	1	$0.04	SOD-123F 12 mm^2
Daux	SMC Diode Solutions	ST1300ATR	VF@Io= 1.1 V VRRM= 300.0 V	1	$0.12	SMA 37 mm^2
Dsec	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 1.468 kV	1	NA	CUSTOM 0 mm^2
Dsec2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 1.468 kV	1	NA	CUSTOM 0 mm^2
Dsnub	Fairchild Semiconductor	SSA24	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.17	SMA 37 mm^2
Dz	Diodes Inc.	MMSZ5250B-7-F	Zener	1	$0.04	SOD-123 13 mm^2
M1	ON Semiconductor	NTP5860NG	VdsMax= 60.0 V IdsMax= 220.0 Amps	1	$1.64	TO-220AB 79 mm^2
O1	Vishay-Semiconductor	TCMT1107	Optocoupler	1	$0.19	SOP-4 44 mm^2
Q1	Fairchild Semiconductor	FJD5304DTF	Bipolar Transistor	1	$0.38	DPAK 102 mm^2
Qsc	STMicroelectronics	2N2222A	Bipolar Transistor	1	$1.19	TO-18 57 mm^2
R11	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
R12	Yageo	RC0201FR-0715K4L Series= ?	Res= 15.4 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
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

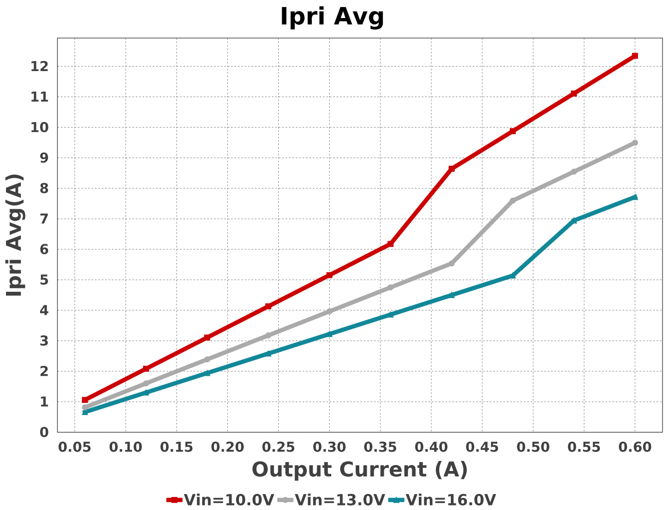
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
R21	Yageo	RC0201FR-0715K4L Series= ?	Res= 15.4 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm²
R22	Vishay-Dale	CRCW04023M74FKED Series= CRCW..e3	Res= 3.74 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Raux	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rbias	Vishay-Dale	CRCW080513K7FKEA Series= CRCW..e3	Res= 13.7 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 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	Stackpole Electronics Inc	RSMF1FT8R20 Series= ?	Res= 8.2 Ohm Power= 1.0 W Tolerance= 1.0%	1	$0.04	RSMF1 107 mm²
Rfbb	Vishay-Dale	CRCW04024K02FKED Series= CRCW..e3	Res= 4.02 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rfbt	Yageo	RC1206FR-07270KL Series= ?	Res= 270.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm²
Rled	Yageo	RC0201FR-0723K7L Series= ?	Res= 23.7 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm²
Rsc	Vishay-Dale	CRCW04024K02FKED Series= CRCW..e3	Res= 4.02 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rsns	CUSTOM	CUSTOM Series= ?	Res= 12.0262 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm²
Rsnub1	CUSTOM	CUSTOM Series= ?	Res= 26.949 Ohm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm²
Rsnub2	CUSTOM	CUSTOM Series= ?	Res= 26.949 Ohm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm²
Rstartup1	Vishay-Dale	CRCW1206226RFKEA Series= CRCW..e3	Res= 226.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm²
Rstartup2	Vishay-Dale	CRCW1206226RFKEA Series= CRCW..e3	Res= 226.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm²
Rt	Vishay-Dale	CRCW04028K66FKED Series= CRCW..e3	Res= 8.66 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rz	Yageo	FMP300JR-73-27K Series= ?	Res= 27.0 kOhm Power= 3.0 W Tolerance= 5.0%	1	$0.05	FMP300 181 mm²
T1	CUSTOM	CUSTOM	Lp= 755.924 nH Rp= 870.0 mOhm Leakage_L= 15.118 nH Ns1toNp= 35.235 Rs1= 8.6 mOhms Ns2toNp= 2.47 Rs2= 700.0 µOhms	1	NA	CUSTOM 0 mm²

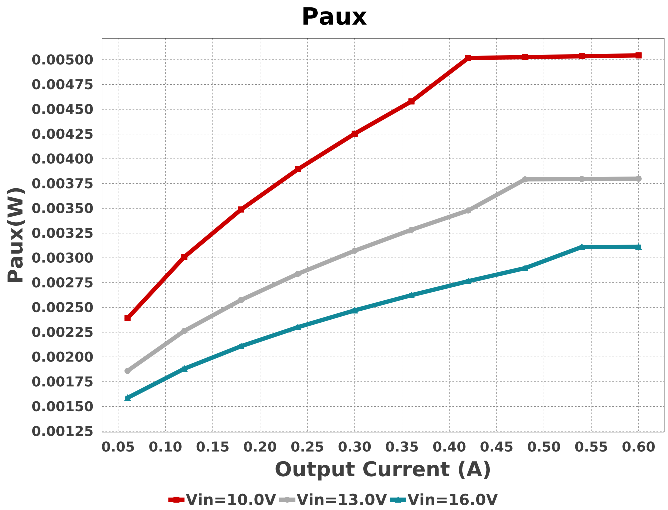
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
U1	Texas Instruments	UC3845N	Switcher	1	$0.59	P0008A 116 mm^2
VR	Texas Instruments	TL431IDBVR	Voltage References	1	$0.06	R-PDSO-G3 16 mm^2

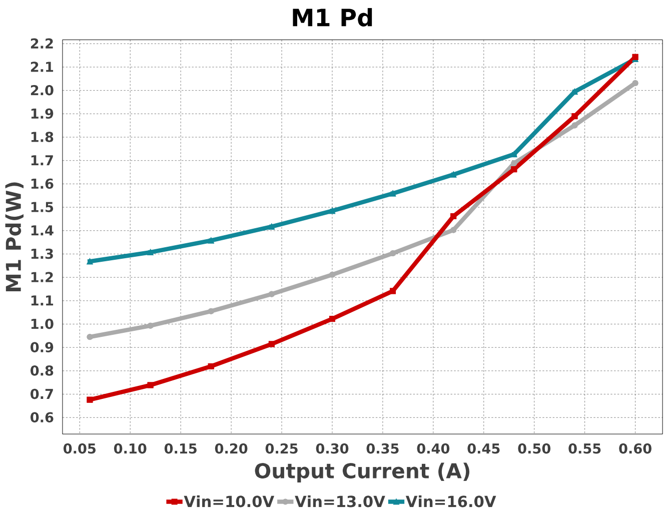


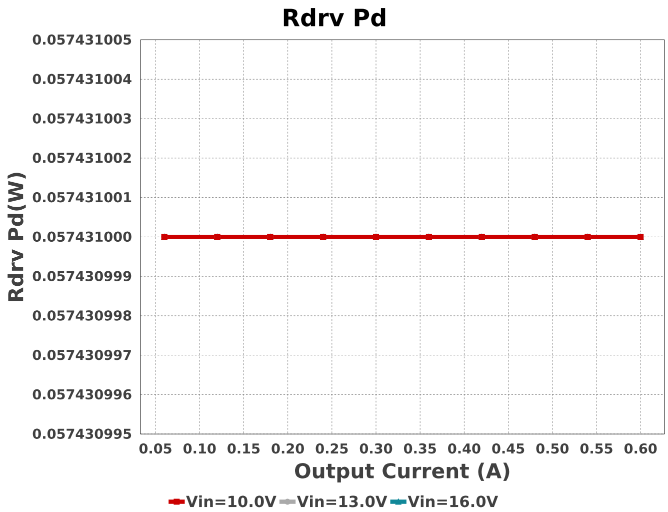




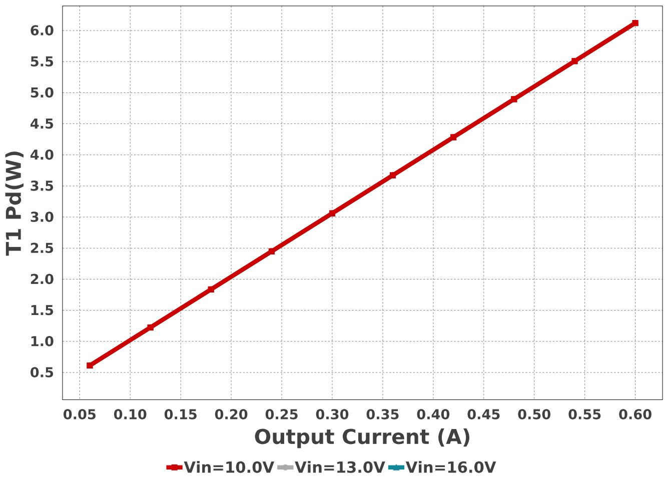








T1 Pd



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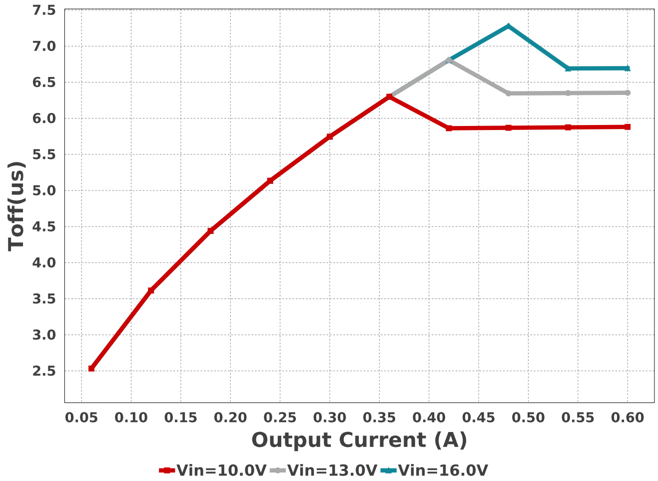
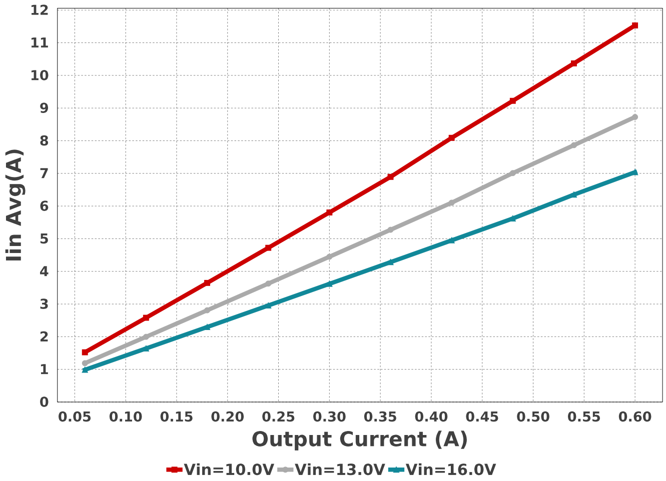
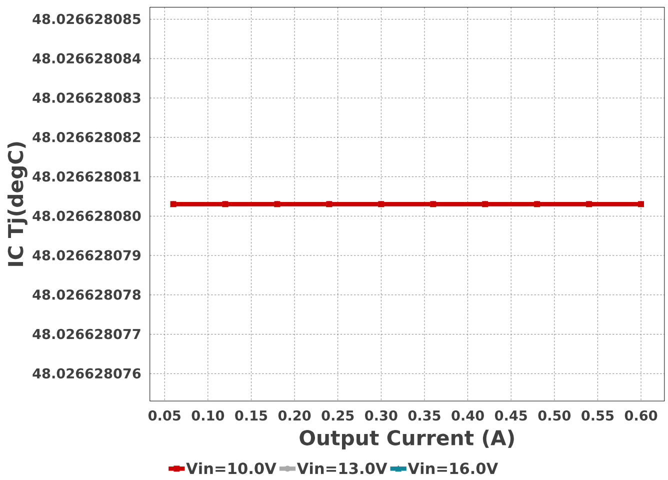


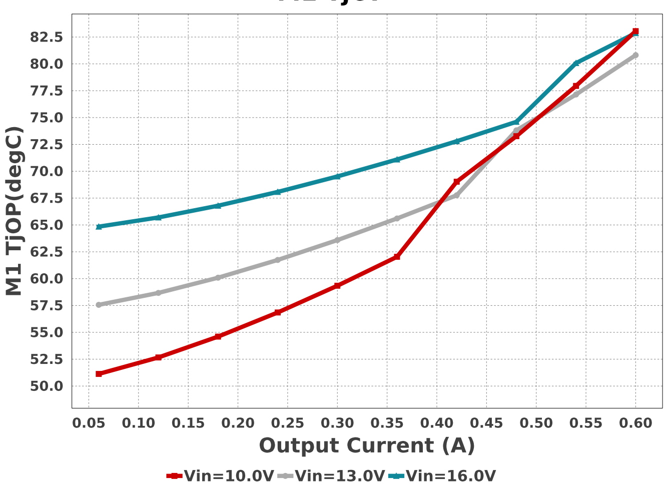
Iin Avg



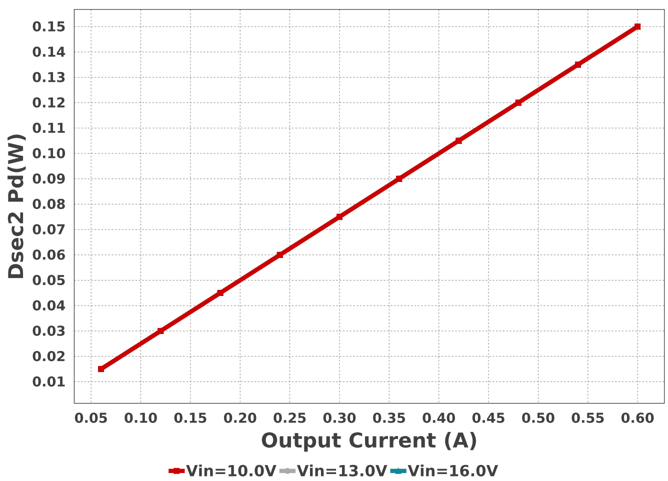
IC Tj



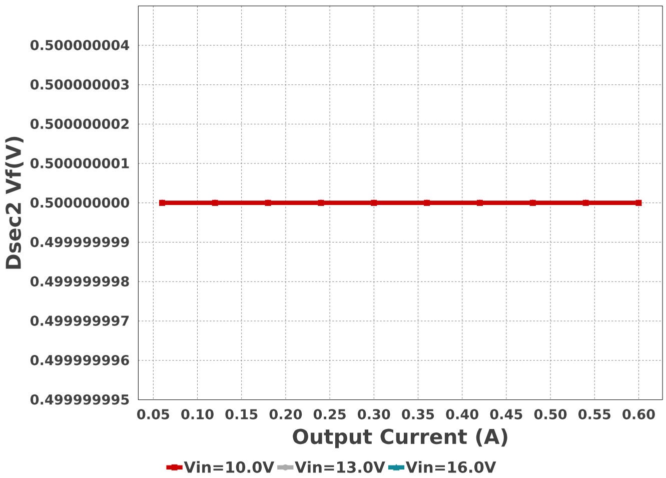
M1 TjOP



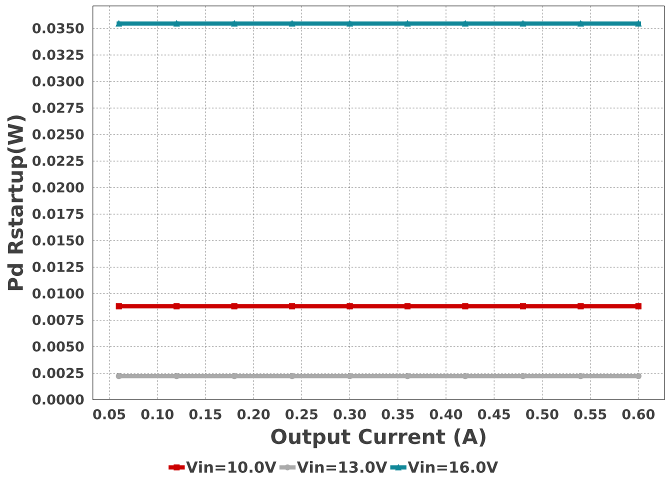
Dsec2 Pd



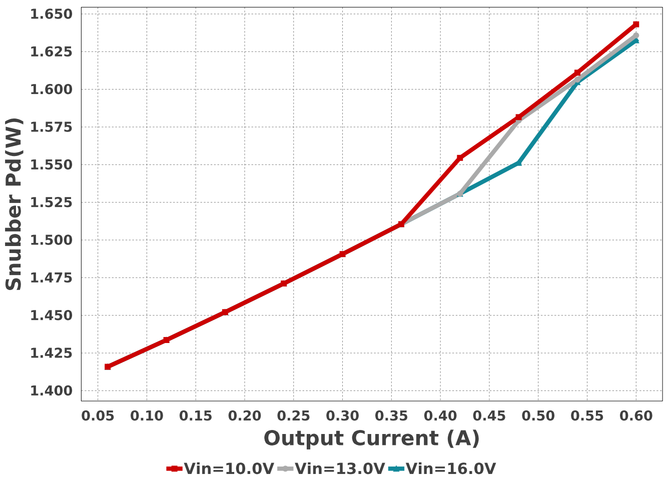
Dsec2 Vf



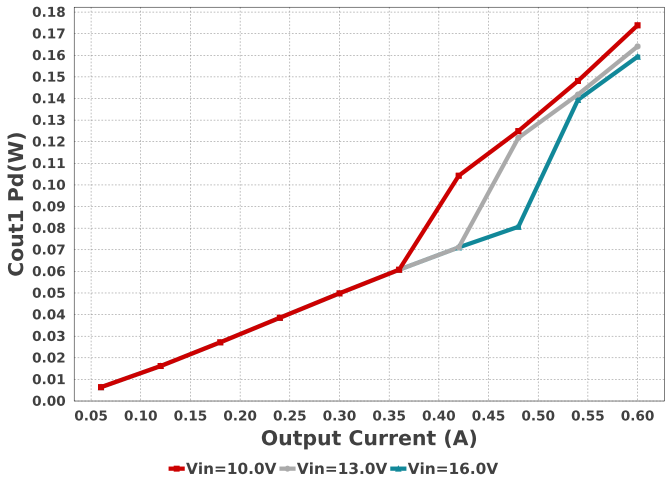
Pd Rstartup



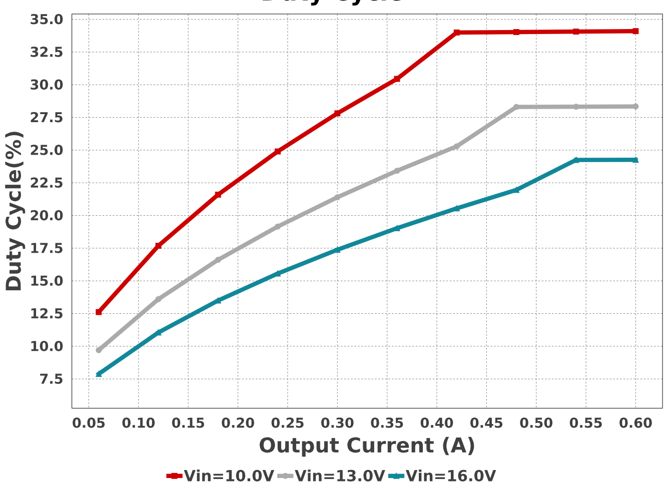
Snubber Pd



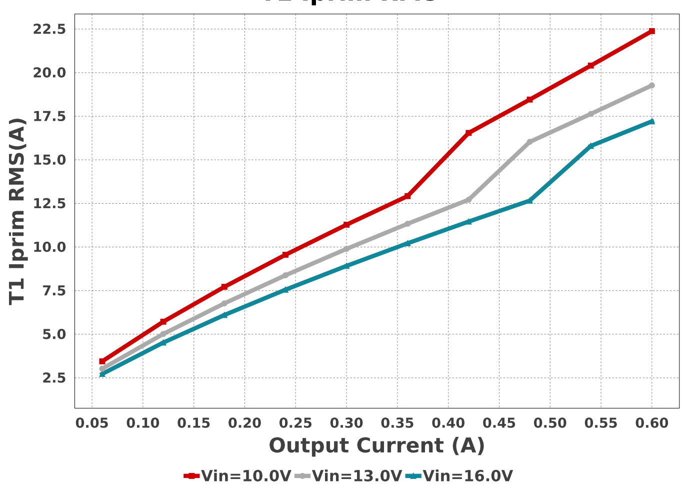
Cout1 Pd

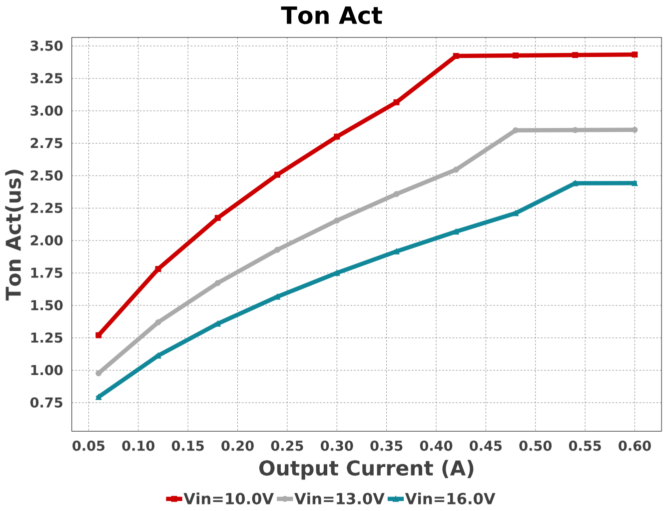


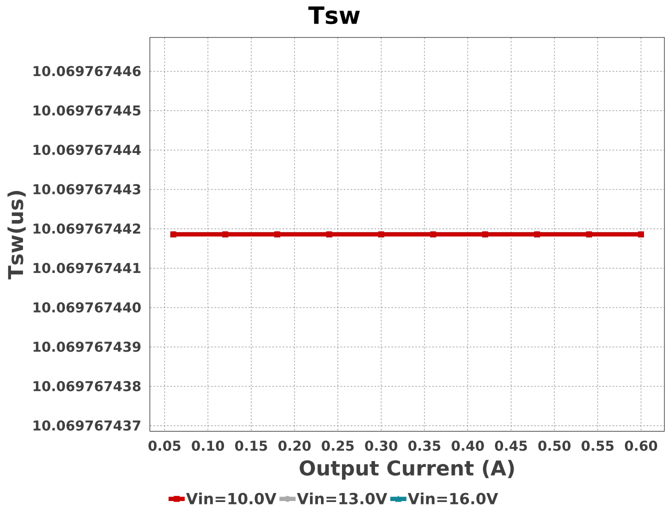
Duty Cycle

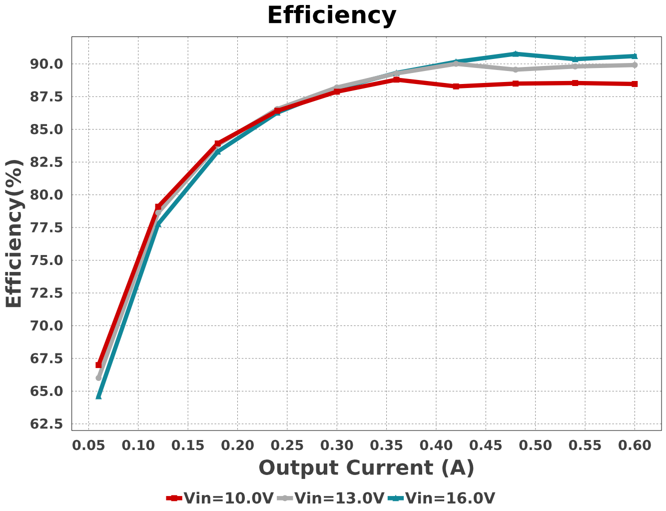


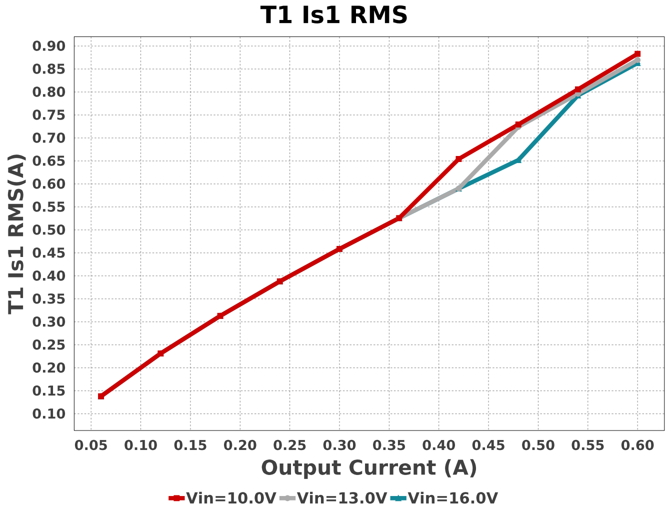
T1 Iprim RMS

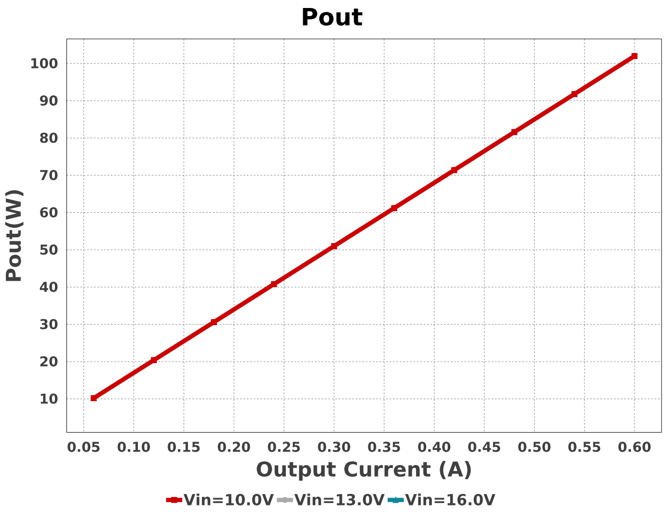


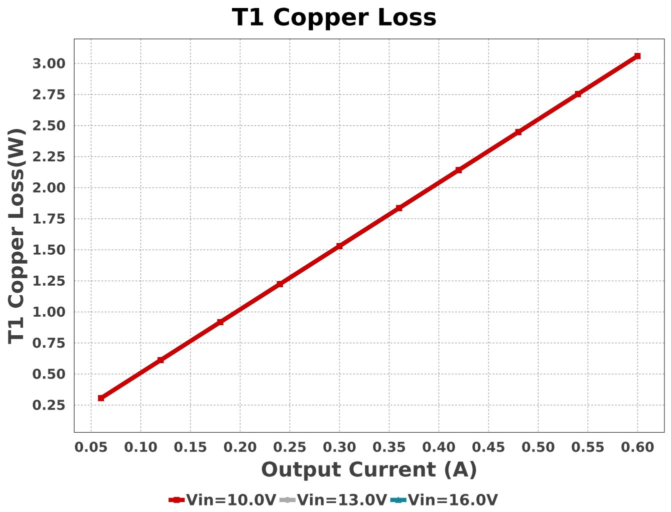

Ton Act
Ton Act(us)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V

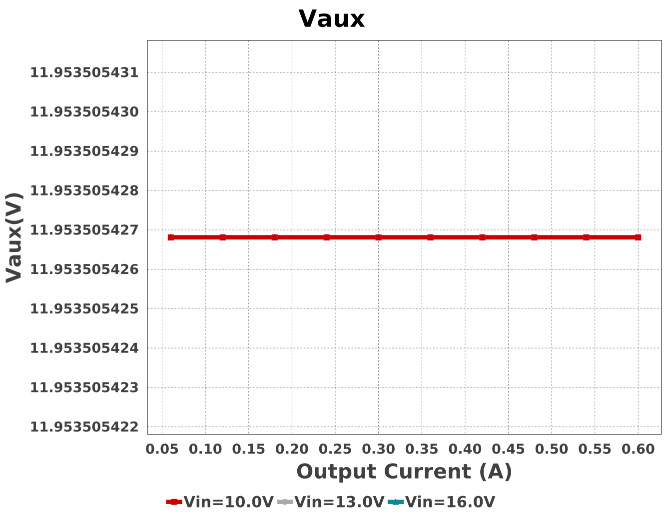

Tsw
Tsw(us)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V

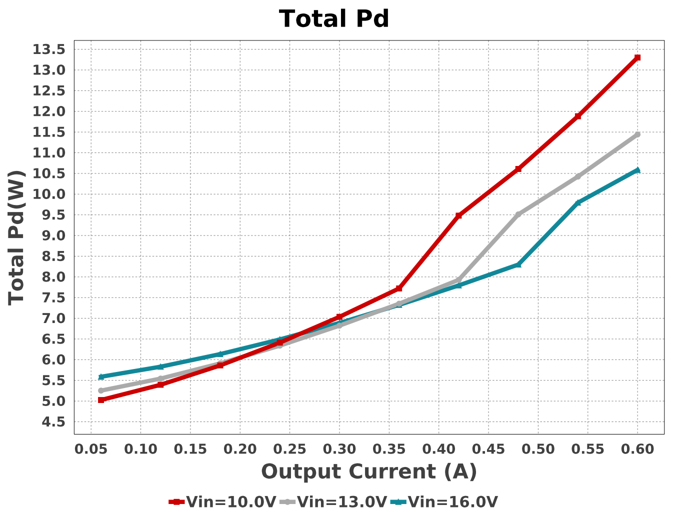

Efficiency
Efficiency(%)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V

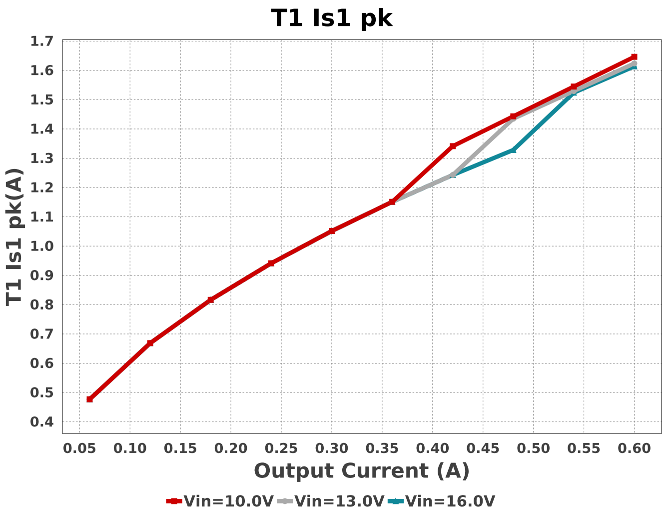

T1 Is1 RMS
T1 Is1 RMS(A)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V

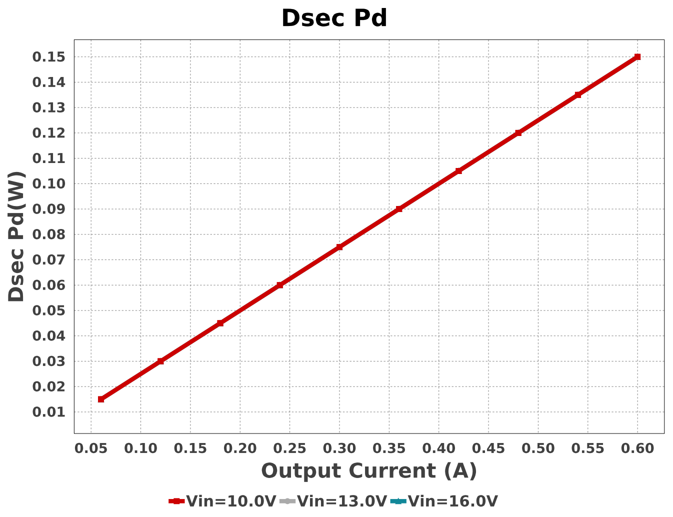

Pout
Pout(W)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V

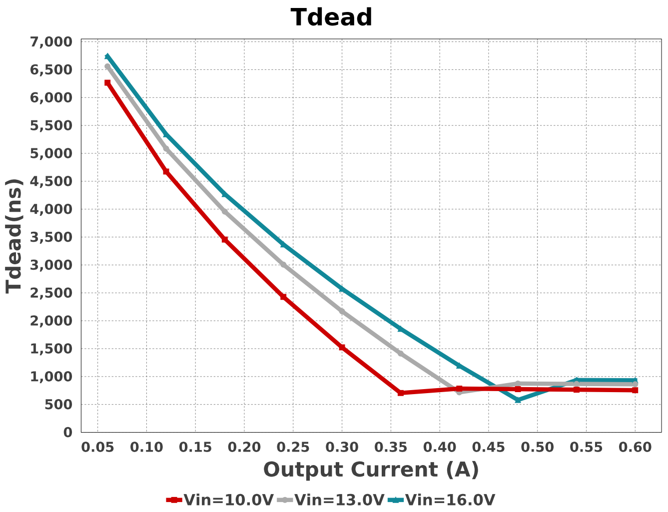

T1 Copper Loss
T1 Copper Loss(W)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V

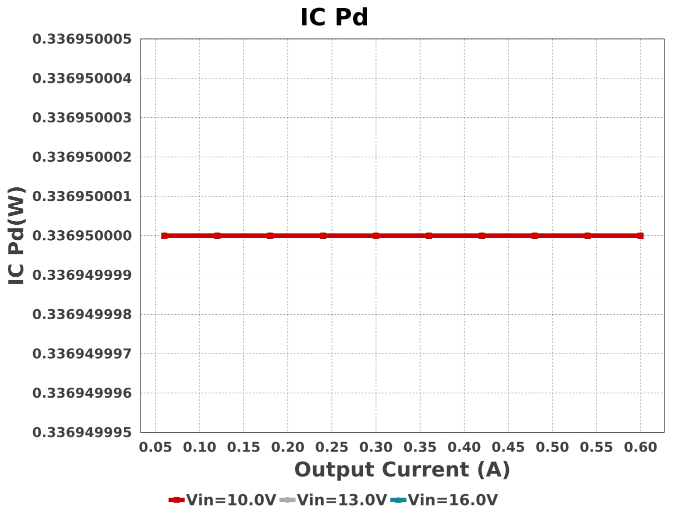

Vaux
Vaux(V)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V


Total Pd
Total Pd(W)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V

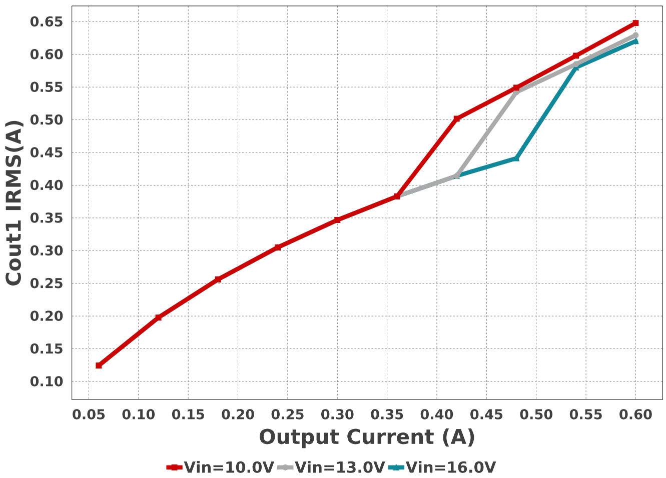

T1 Is1 pk
T1 Is1 pk(A)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V


Dsec Pd
Dsec Pd(W)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V

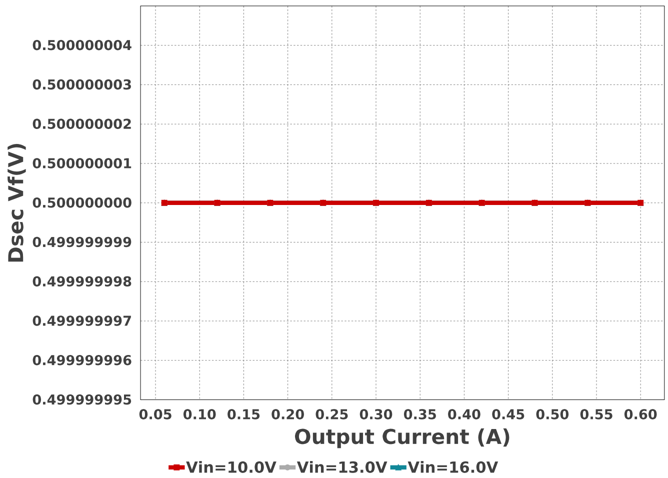

Tdead
Tdead(ns)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V


IC Pd
IC Pd(W)
Output Current (A)
Vin=10.0V Vin=13.0V Vin=16.0V

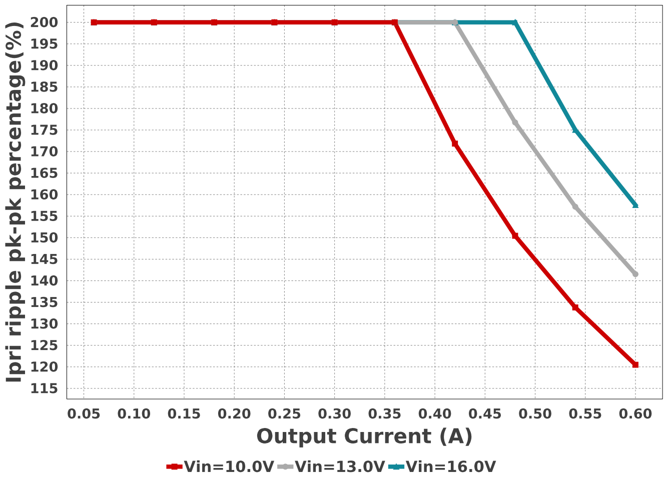
Cout1 IRMS



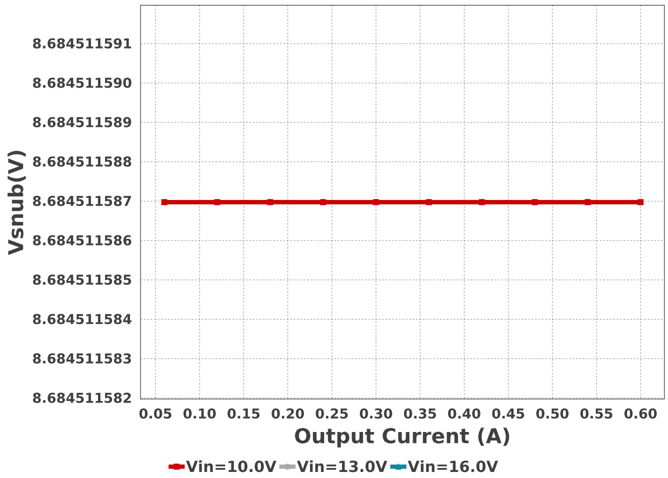
Dsec Vf



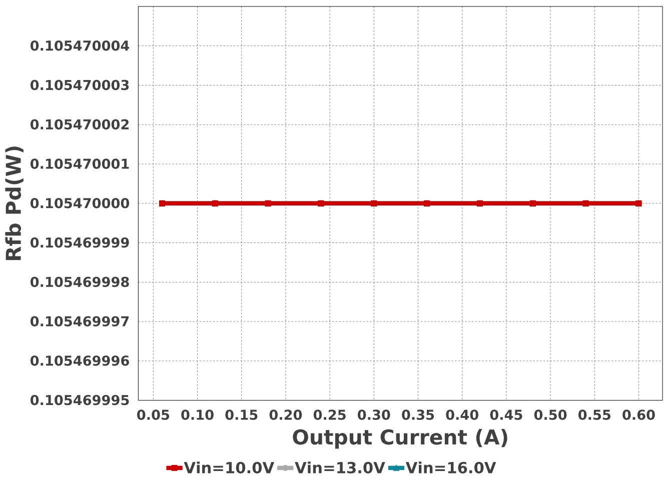
Ipri ripple pk-pk percentage



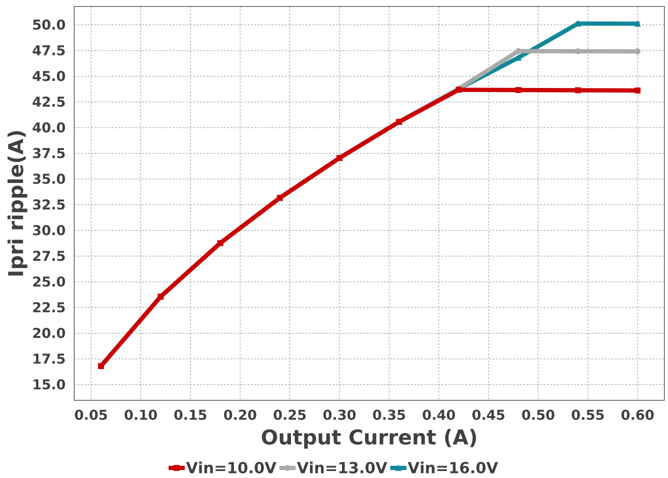
Vsnub

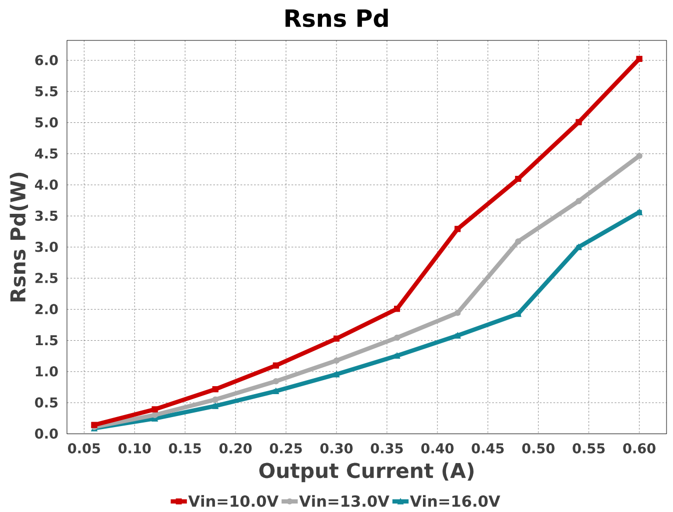


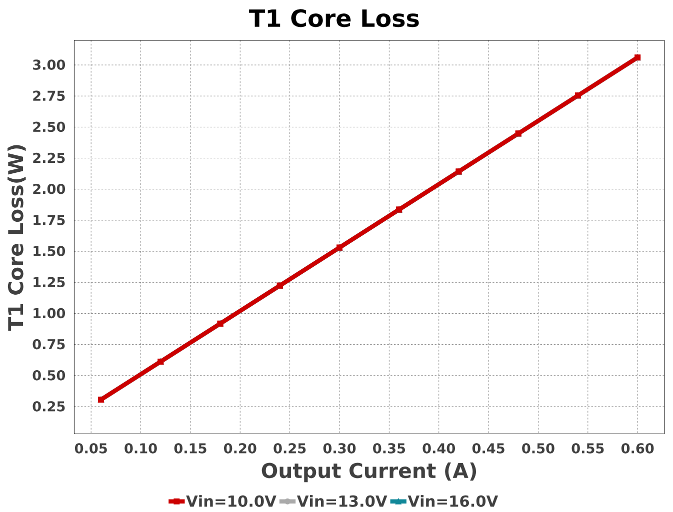
Rfb Pd

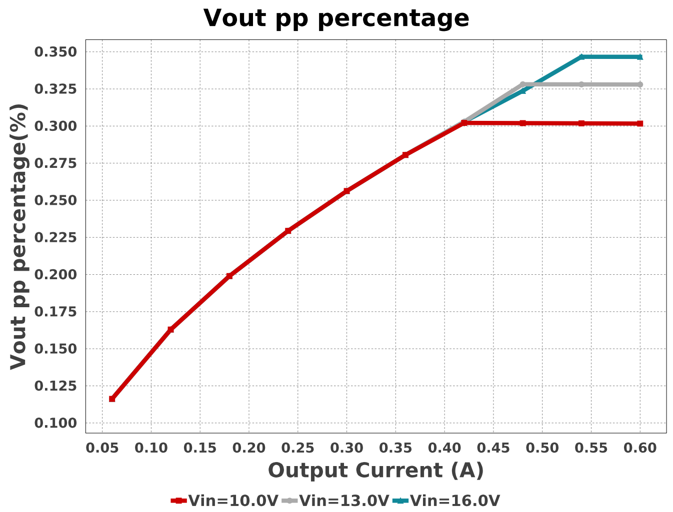


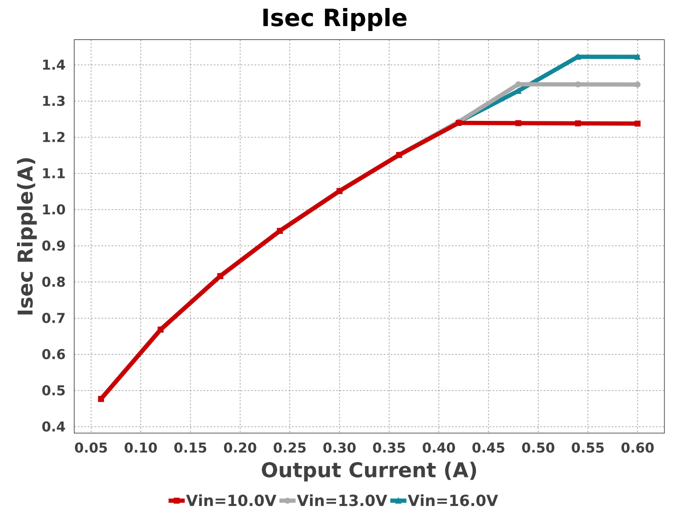
Ipri ripple

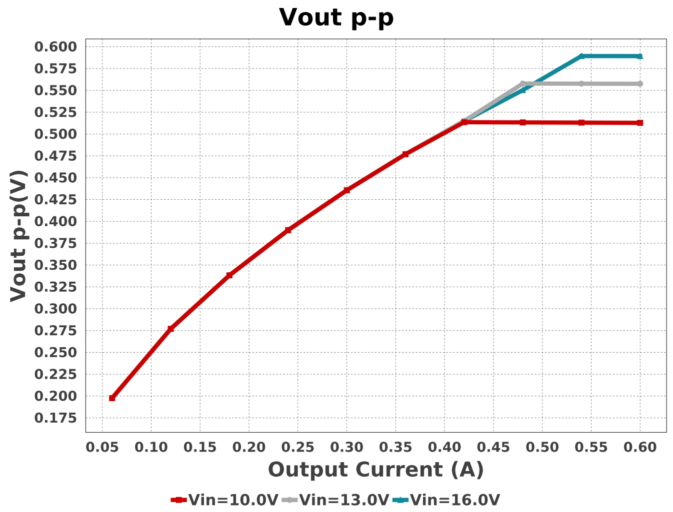


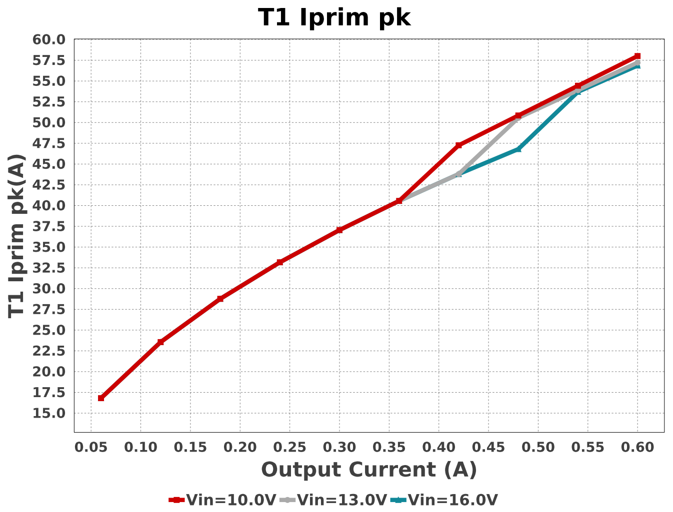












Operating Values

#	Name	Value	Category	Description
1.	Cin Pd	398.11 mW	Capacitor	Input capacitor power dissipation
2.	Cout1 IRMS	647.847 mA	Capacitor	Output capacitor1 RMS ripple current
3.	Cout1 Pd	173.88 mW	Capacitor	Output capacitor1 power dissipation
4.	Daux trr	35.0 ns	Diode	Auxiliary Diode Reverse Recovery Time
5.	Dsec Pd	150.0 mW	Diode	Secondary Diode Power Dissipation
6.	Dsec Vf	500.0 mV	Diode	Effective Forward Voltage Drop at the Operating Current
7.	Dsec trr	0.0 ns	Diode	Output Diode Reverse Recovery Time
8.	Dsec2 Pd	150.0 mW	Diode	Secondary Diode Power Dissipation
9.	Dsec2 Vf	500.0 mV	Diode	Effective Forward Voltage Drop at the Operating Current
10.	Dsnub trr	9.84 ns	Diode	Snubber Diode Reverse Recovery Time
11.	IC Pd	336.95 mW	IC	IC power dissipation

#	Name	Value	Category	Description
12.	IC Tj	48.027 degC	IC	IC junction temperature
13.	ICThetaJA	53.5 degC/W	IC	IC junction-to-ambient thermal resistance
14.	Iin Avg	11.53 A	IC	Average input current
15.	M1 Pd	2.143 W	Mosfet	M1 MOSFET total power dissipation
16.	M1 TjOP	113.63 degC	Mosfet	M1 MOSFET junction temperature
17.	Cin Pd	398.11 mW	Power	Input capacitor power dissipation
18.	Cout1 Pd	173.88 mW	Power	Output capacitor1 power dissipation
19.	Dsec Pd	150.0 mW	Power	Secondary Diode Power Dissipation
20.	Dsec2 Pd	150.0 mW	Power	Secondary Diode Power Dissipation
21.	IC Pd	336.95 mW	Power	IC power dissipation
22.	M1 Pd	2.143 W	Power	M1 MOSFET total power dissipation
23.	Paux	5.044 mW	Power	Power Dissipation in Raux and Daux
24.	Pd Rstartup	8.817 mW	Power	Power Dissipation in Rstartup1 and Rstartup2
25.	Rdrv Pd	57.431 mW	Power	Power Dissipation in Gate Drive Resistor
26.	Rfb Pd	105.47 mW	Power	Rfb Power Dissipation
27.	Rsns Pd	6.024 W	Power	Current Limit Sense Resistor Power Dissipation
28.	Snubber Pd	1.643 W	Power	Snubber Power Dissipation
29.	T1 Copper Loss	3.06 W	Power	Transformer Copper Loss Power Dissipation
30.	T1 Core Loss	3.06 W	Power	Transformer Core Loss Power Dissipation
31.	T1 Pd	6.12 W	Power	Estimated Losses in Transformer
32.	Total Pd	13.3 W	Power	Total Power Dissipation
33.	Pd Rstartup	8.817 mW	Resistor	Power Dissipation in Rstartup1 and Rstartup2
34.	Rdrv Pd	57.431 mW	Resistor	Power Dissipation in Gate Drive Resistor
35.	Rfb Pd	105.47 mW	Resistor	Rfb Power Dissipation
36.	Rsns Pd	6.024 W	Resistor	Current Limit Sense Resistor Power Dissipation
37.	BOM Count	54	System Information	Total Design BOM count
38.	Duty Cycle	34.1 %	System Information	Duty cycle
39.	Efficiency	88.465 %	System Information	Steady state efficiency
40.	FootPrint	2.216 k mm^2	System Information	Total Foot Print Area of BOM components
41.	Frequency	99.307 kHz	System Information	Switching frequency
42.	Iout	600.0 mA	System Information	Iout operating point
43.	Iout_DCM	411.162 mA	System Information	Approximate Current below which DCM mode of operation will begin
44.	Mode	CCM	System Information	Conduction Mode
45.	Pout	102.0 W	System Information	Total output power
46.	Tdead	755.066 ns	System Information	Approximate Dead Time of the Regulator
47.	Toff	5.881 us	System Information	Approximate Converter Off Time
48.	Ton Act	3.434 us	System Information	Approximate Converter On Time
49.	Total BOM	NA	System Information	Total BOM Cost
50.	Tsw	10.07 us	System Information	Switching Time Period
51.	Vin	10.0 V	System Information	Vin operating point
52.	Vout	170.0 V	System Information	Operational Output Voltage
53.	Vout Actual	170.07 V	System Information	Vout Actual calculated based on selected voltage divider resistors
54.	Vout Tolerance	2.318 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
55.	Vout p-p	512.812 mV	System Information	Peak-to-peak output ripple voltage
56.	Vout pp percentage	301.654 m%	System Information	Output Voltage ripple percentage
57.	Vsnub	8.685 V	System Information	Voltage Across the Snubber
58.	Ipri Avg	12.344 A	Transformer	Average Current in Primary Winding over the complete Switching Period
59.	Ipri ripple	43.615 A	Transformer	Ripple Current in the Primary Winding
60.	Ipri ripple pk-pk percentage	120.485 %	Transformer	Primary Current pk-pk ripple percentage(of Ipri avg during ton only)
61.	Isec Ripple	1.238 A	Transformer	Ripple Current in the Secondary Winding
62.	Paux	5.044 mW	Transformer	Power Dissipation in Raux and Daux
63.	T1 Copper Loss	3.06 W	Transformer	Transformer Copper Loss Power Dissipation
64.	T1 Core Loss	3.06 W	Transformer	Transformer Core Loss Power Dissipation

#	Name	Value	Category	Description
65.	T1 Iprim RMS	22.381 A	Transformer	Transformer Primary RMS Current
66.	T1 Iprim pk	58.007 A	Transformer	Transformer Primary Peak Current
67.	T1 Is1 RMS	883.009 mA	Transformer	Transformer Secondary1 RMS Current
68.	T1 Is1 pk	1.646 A	Transformer	Transformer Secondary1 Peak Current
69.	T1 Pd	6.12 W	Transformer	Estimated Losses in Transformer
70.	Vaux	11.954 V	Transformer	Auxiliary Voltage

Design Inputs

Name	Value	Description
Iout	600.0 m	Maximum Output Current
VinMax	16.0	Maximum input voltage
VinMin	10.0	Minimum input voltage
Vout	170.0	Output Voltage
base_pn	UC3845	Base Product Number
source	DC	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

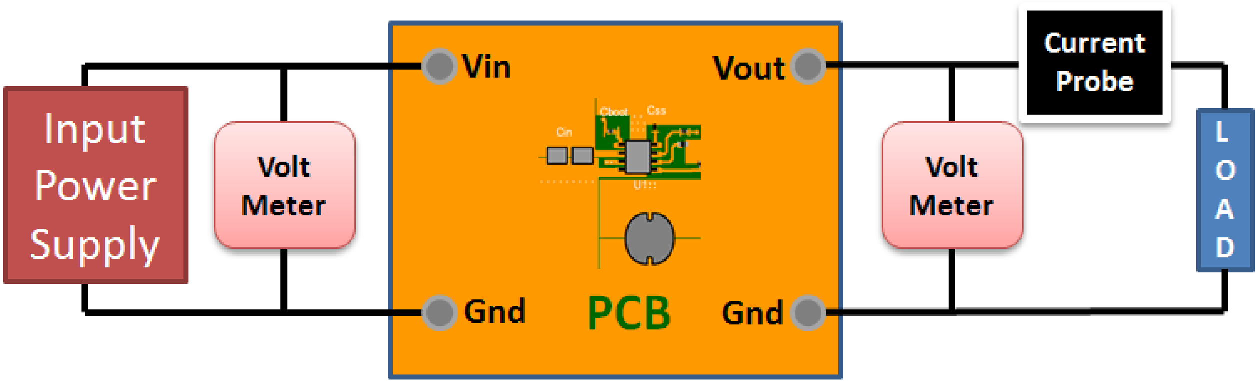
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 10.0V 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.



Design Assistance

1. Master key : D91F86E9F9228B5C96BBC4BE57FAB068[v1]

2. **UC3845** Product Folder : http://www.ti.com/product/UC3845 : contains the data sheet and other resources.

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